DECEMBER 1959—SIXTY-SIXTH YEAR

Machinery

SOME OF THE HARDINGE PRECISION MACHINES

AT MOTOROLA WESTERN MILITARY ELECTRONICS CENTER, PHOENIX, ARIZONA

FOR

PRECISION TOOL ROOM WORK, DEVELOPMENT AND PRODUCTION

if you surface grind small work

CHUCK IT HERE

on the HEALD MODEL 161 ROTARY

WHEN you want to get a better finish, easier and at *lower cost*, put your small surface grinding work on a Heald Model 161 Rotary. Available with a standard 6" chuck and 8" auxiliary top plate, it will handle work with a swing of up to 12½" inside the guard. On long runs or short, it will give you the high precision and fine surface finish that you'd expect only from a larger and much more costly machine.

Only the Heald Model 161 Rotary Surface Grinder offers you all these big-machine features in a small-size, low price unit: manual or power reciprocation — dry or wet grinding — simple operation — precision chuck swivel for flat, convex or concave grinding — powerful direct-drive wheelhead — vertical column construction — precision calibrated feed control — and anti-friction table with hardened steel box-type ways riding on hardened steel rollers.

Completely modern in every detail, this machine offers a low-cost solution to your rotary grinder obsolescence problems, or to the equally serious problem of tieing up a bigger machine on work than can be handled more easily and economically on the 161. Ask your Heald engineer for complete information, or send for Bulletin No. 2-161-1.

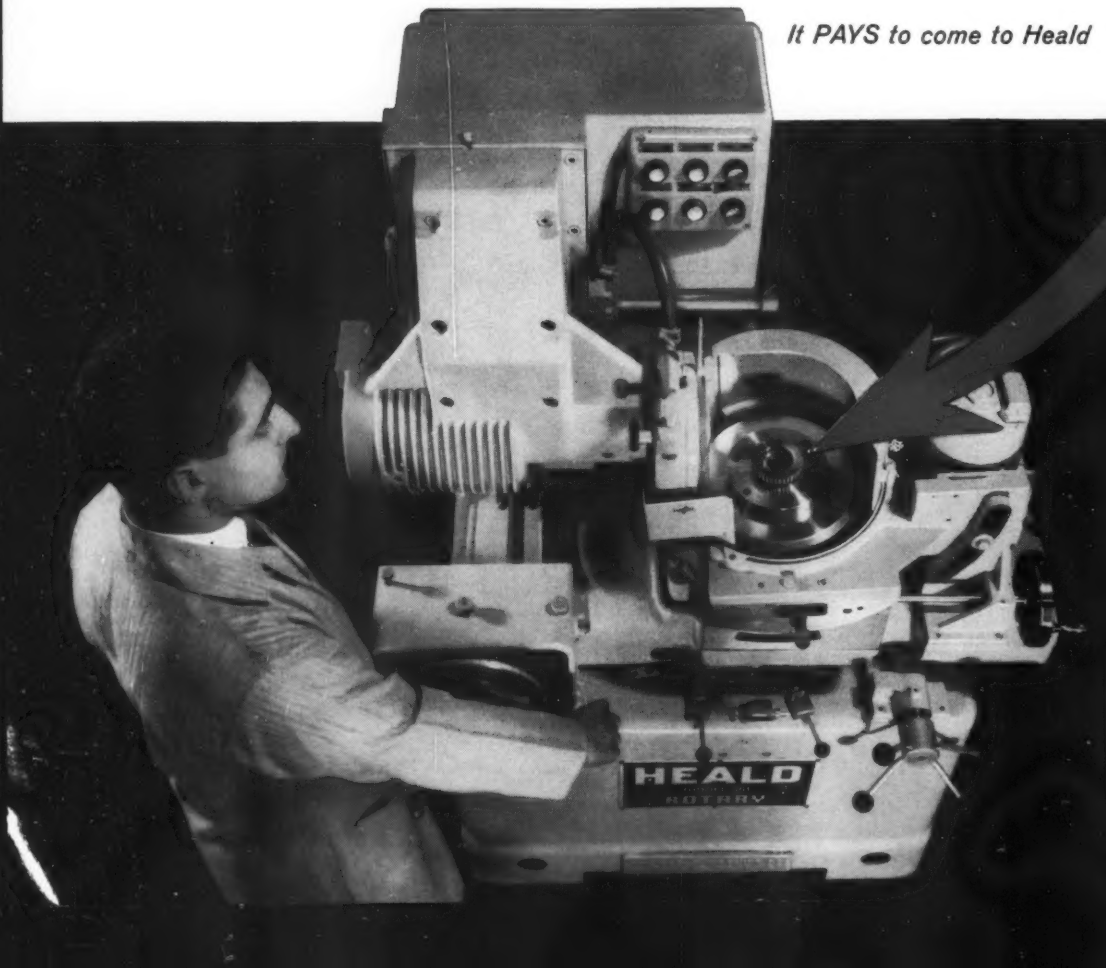
THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York • Philadelphia • Syracuse

It PAYS to come to Heald



HEALD

DECEMBER 1959

VOL. 66 No. 4

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Great Britain
MACHINERY
National House, West St., Brighton 1, England

France
LA MACHINE MODERNE
15, Rue Bleue, Paris-IXe, France

BPA NBP

Machinery

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

SHOP PRACTICE

MACHINE AND TOOL DESIGN

MANAGEMENT PROBLEMS AND MEETINGS

DEPARTMENTS

Recent Landis sales figures show that 7 out of 10 successful Threading Operations require some Engineering to assure the utmost in Threading efficiency. "Threading Equipment by Landis" includes Engineering Service geared to offer help with any Threading Operation. This Engineering Service is the best available. Backed by the resources of the World's Largest Manufacturer of Threading Equipment, our Engineering Department is able to handle every type of Technological requirement.

For example, a LANDIS 32AX LANDMATIC Heat Treated Die Head was recently engineered for application to a No. 1AC Warner and Swasey automatic chucking machine to produce two different thread diameters simultaneously in one pass on a single workpiece. This two diameter threading greatly reduced threading and material handling time.

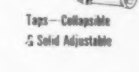
Plants everywhere benefit from the knowledge our Engineering Department applies to every threading operation. Advice on thread design, the proper threading method to use, the proper threading equipment to use, and the development of special tooling, fixtures, or equipment for unusual operations are among the services offered. Engineering Service can also mean much to you in the solution of your daily Threading Problems—whether in Cutting, Rolling, Tapping or Grinding.

LANDIS *Machine* COMPANY

WAYNESBORO · PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

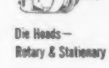
Threading Machines



Taps—Collapsible & Solid Adjustable

Centerless Thread Grinding Machines

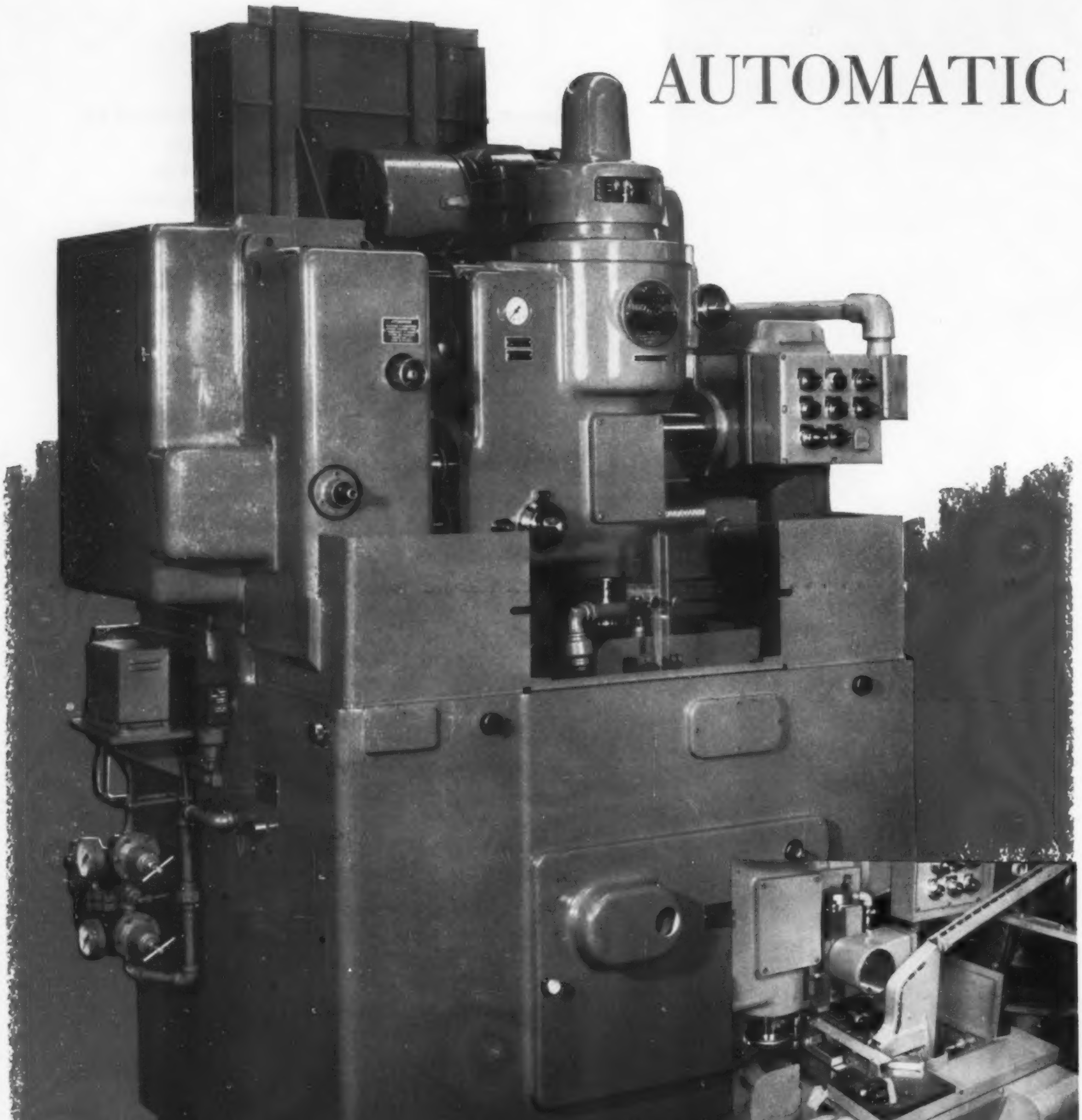
Thread Rolling Machines



Die Heads—Rotary & Stationary

Thread Rolling Tools

AUTOMATIC

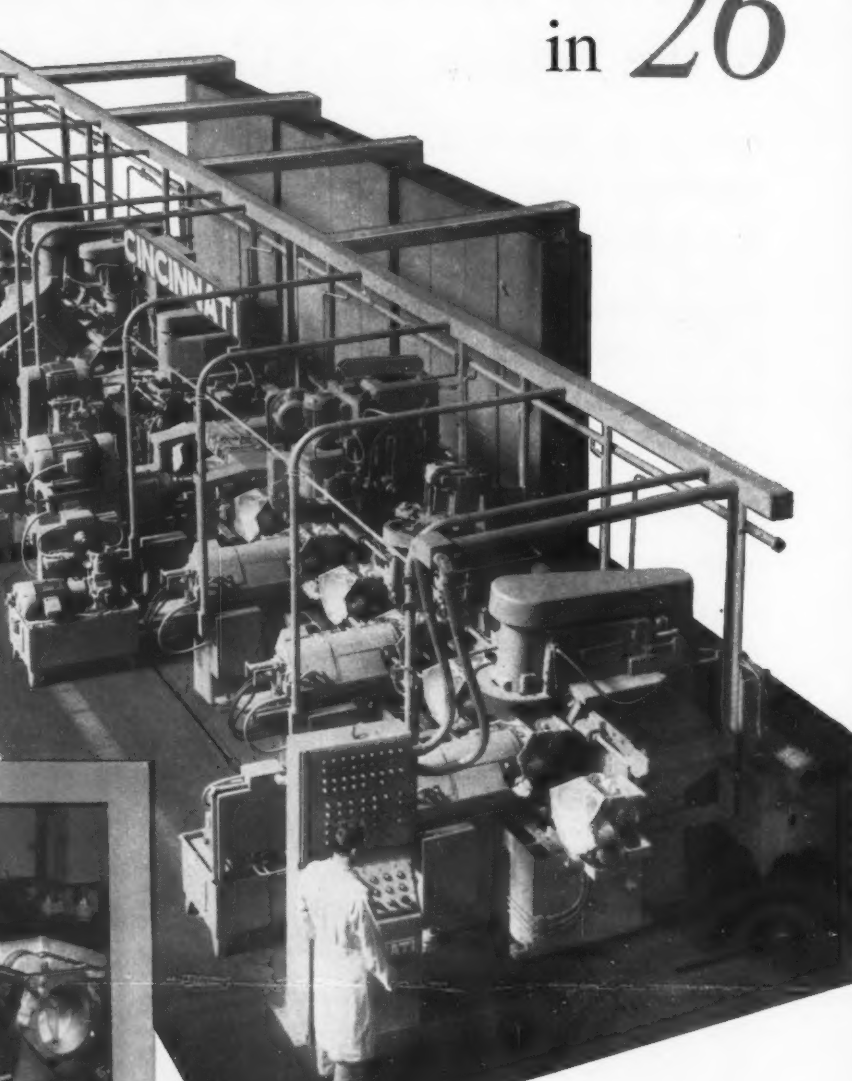


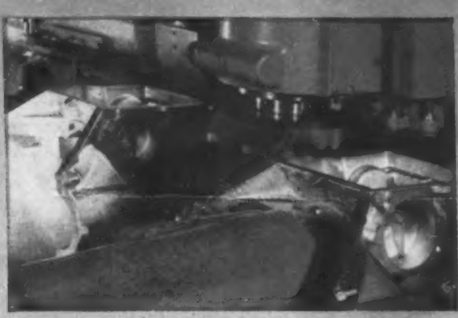
This automotive pinion is fed automatically from a vibratory feeder down a chute to the magazine slide from which it is located and clamped on an expanding arbor. The pinion is cut, stripped from the arbor and ejected into the unloading chute. Total elapsed time, one minute. *Gear Data:* 16 Teeth, 18 Pitch, 20° Pressure Angle, 18° 30′ Helix Angle, 5/8″ Face Width.

THE PRECISION LINE

Fellows

CINCINNATI | SPECIAL MACHINE DIVISION incorporates in *26*





Rough milling the pan face, station 2. This is the first machining operation on the transmission line.

CINCINNATI 26-STATION TRANSFER LINE at Ford Motor Company's new plant in Sharonville, Ohio, automatically bores, mills and drills automatic transmission cases in 33 machining operations. Accuracy and finish are excellent. The machine cycles 137 times per hour.

DESIGNERS AND BUILDERS OF SPECIAL MACHINES • VERTICAL AND HORIZONTAL BROACHING

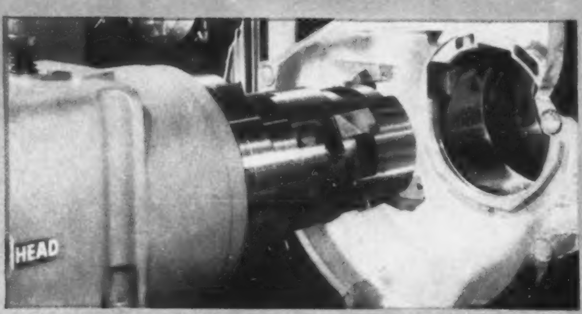
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

Dependable Productivity

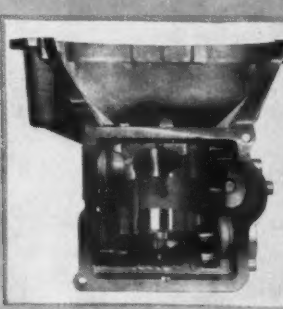
-station TRANSFER LINE...

Aluminum transmission cases require gentle handling and firm, balanced clamping during the machining operations . . . and a high degree of dependability in the production equipment. All these requirements are incorporated in the CINCINNATI 26-Station Unit Type Transfer Machine illustrated at the left. This production line mills, drills and bores Ford automatic transmission cases; inserts two bushings; automatically banks excess parts; transfers the casting from one station to the next. There are 26 stations, allocated as follows: 10 for machining, one for inserting bushings, one for banking, one for future engineering changes, and the remainder for other functions required in a modern transfer line. Several outstanding advantages are incorporated in this line, including unit construction and complete static electrical control.

Cincinnati engineers and builds special machines and complete production lines varying in complexity from small bearing-shell broaching machines to giant production lines performing a multitude of operations. Make Cincinnati your first choice for equipment of this type. The Special Machine Division is ready to serve you.



Boring and chamfering the large diameter. At the same time, boring and facing operations are performed from the other end. Station 8.



Inside the transmission case. Hard-to-reach surfaces are easily machined on the CINCINNATI Transfer Line.

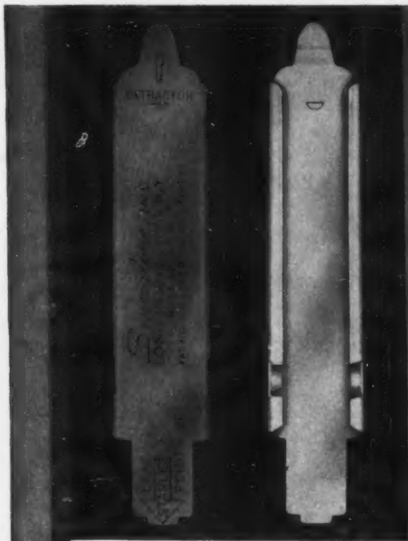
MACHINES • COMPLETELY AUTOMATED PRODUCTION LINES

CINCINNATI®
SPECIAL MACHINE DIVISION

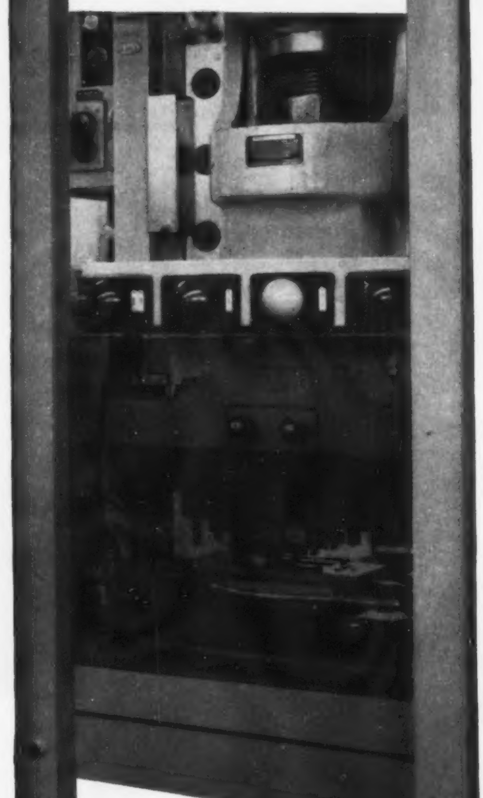
For more data, circle this page number on inquiry card

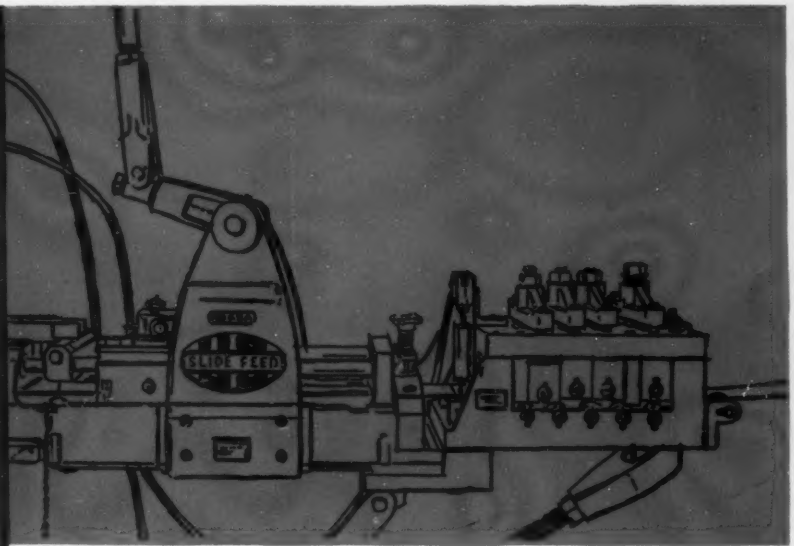
LANDIS
micro


Swingline #101
Staple Gun
The Tool of a
1000 Uses.
Swingline
FULL
EMPTY
101
Swingline INC.
MANUFACTURERS OF STAPLERS, STAPLES & OFFICE SPECIALTIES
TURNS TO
U.S. PRESS ROOM
EQUIPMENT
U S
SLIDE FEED
U S
MULTI-ROLL
CRADLE



FRONT and BACK views of #101 Staple Gun base.





■ Swingline, Incorporated, represents another example of the reliance successful manufacturers place upon U. S. Press Room Equipment.

In the manufacture of their "Swingline No. 101 Staple Gun" Swingline utilizes the U. S. team of "Cradle to Straightener to Slide Feed" — a perfectly matched combination.

Swingline, in the production of their 101 Staple Gun, fabricates the 101 base from .062" coil stock, 1.468" wide. Stock is unwound from a model ACC-1-9C U. S. Multi-Roll Cradle. From the Cradle, stock leads into a model SS-27 U. S. Plain Stock Straightener which removes coil set. The stock is drawn through the Plain Straightener by a model SF-68A U. S. Slide Feed and accurately fed to the press with a feed stroke of 5⅜", at a rate up to 4000 per hour. This particular U. S. Slide Feed has a maximum stock width capacity of 6" and a maximum feed length adjustable up to 8".

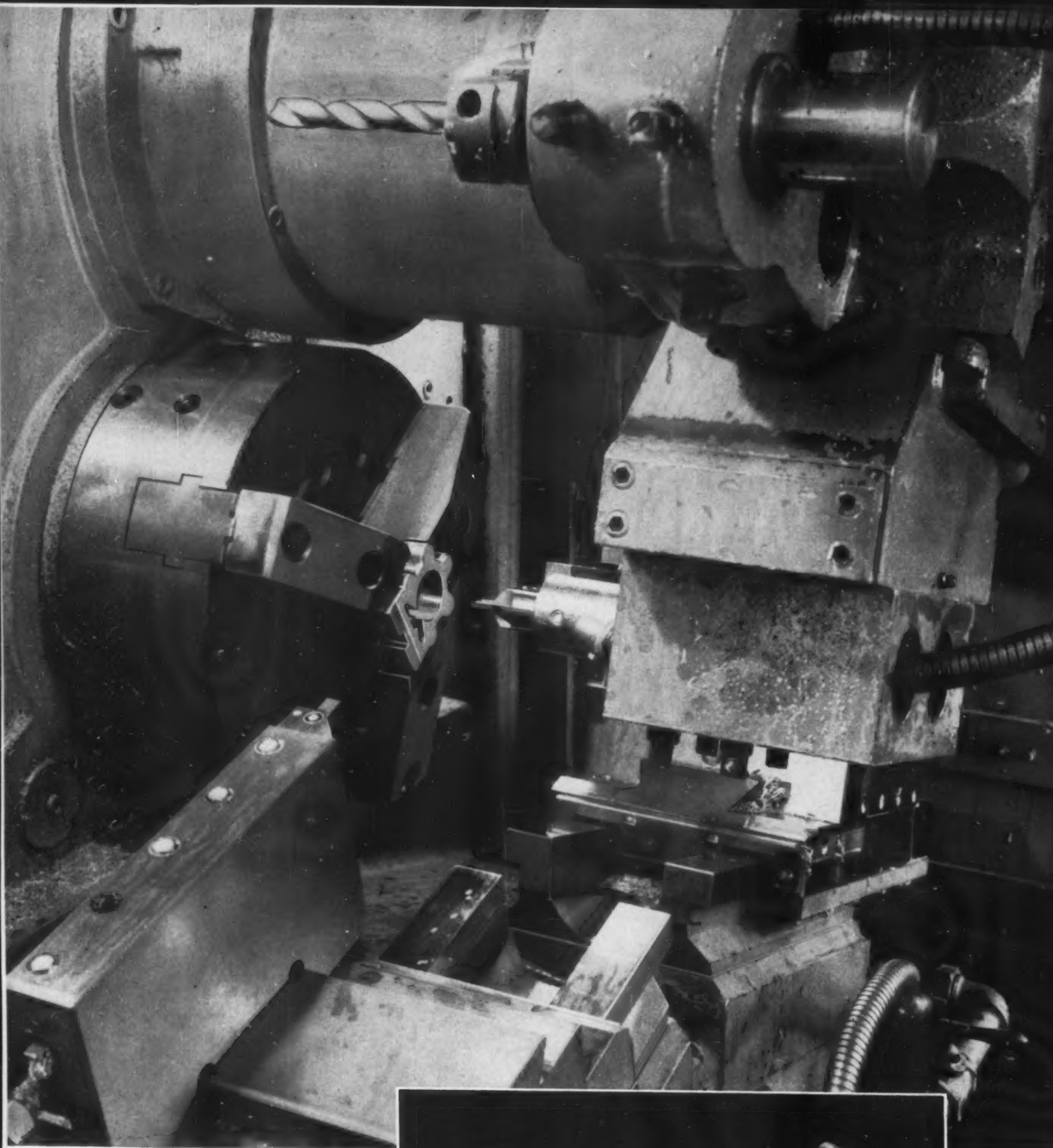
As it has for Swingline and many other manufacturers, U. S. Press Room Equipment can help you to produce a fine product, economically. If yours is a press room production operation, get the complete story about U. S. Press Room Equipment by sending for Bulletin No. 85M.

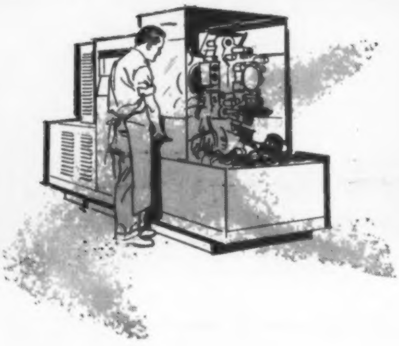
MULTI-SLIDE

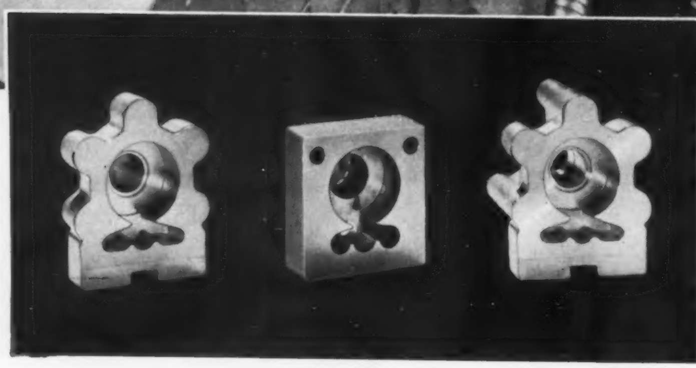
U. S. TOOL COMPANY, INC. AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

For more data, circle this page number on inquiry card



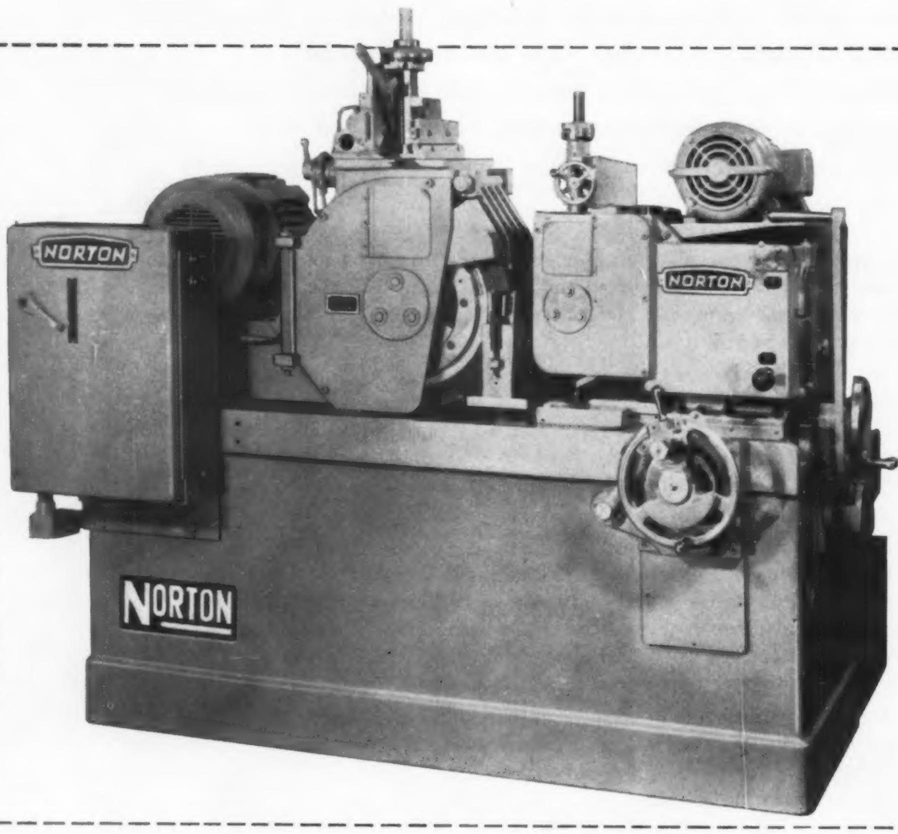




Newest NORTON Grinder!

The No. 2 Straddle-Bearing

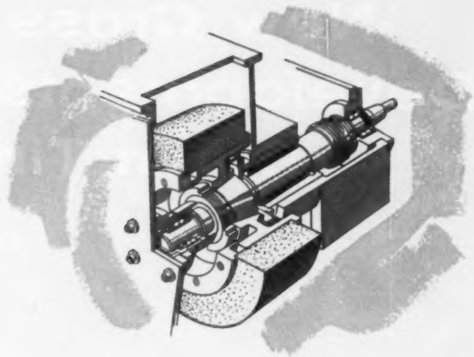
Centerless is built for speed . . .



Ready for Immediate Delivery
The new Norton No. 2 Centerless Grinder can be arranged for full automatic, semi-automatic or manual thru-feed or plunge grinding. Capacity includes work diameters ranging from 1/16" to 4¾" depending on type of work rest and bar grinding fixture.

3 MAJOR ADVANCEMENTS IN CENTERLESS GRINDING

accuracy . . . economy



Straddle-Bearing Spindle Support, in both grinding and regulating wheels, provides extra strength. Combined with the inherent rigidity of Norton spindles this boosts capacity to take heaviest cutting pressures, while permitting fast grinding to close tolerances under all conditions.

Like all Norton grinders and lappers the Norton No. 2 *Straddle-Bearing* Centerless Grinder is built to deliver "Touch of Gold" performance — the Norton extra that adds value to your product while cutting your production costs.

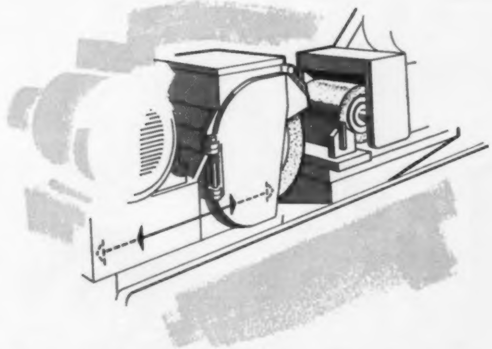
You'll find plenty of proof of that in the modern construction of this newest machine of its type. *Straddle* support of spindle bearings adds strength and ability to take tough jobs . . . the mobile wheel head and constant work-loading alignment make jobs shorter and easier.

Many other features result in outstanding performance advantages. Call your Norton Sales Engineer, a trained expert in the grinding field, for consultation on how these features can benefit your production. Or write for Catalog 1328. NORTON COMPANY, Machine Division, Worcester 6, Mass.

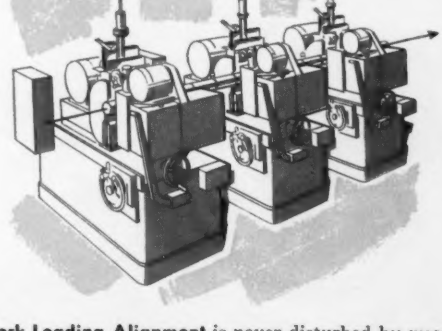
NORTON

GRINDERS and LAPPERS

District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit.
In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.



Mobile Grinding Wheel Head, with wheel mounted between head ways and feed screw located beneath wheel center for ideal balance, provides instant response to signals. This results in especially fast sizing, one of many important advantages over fixed head operation.



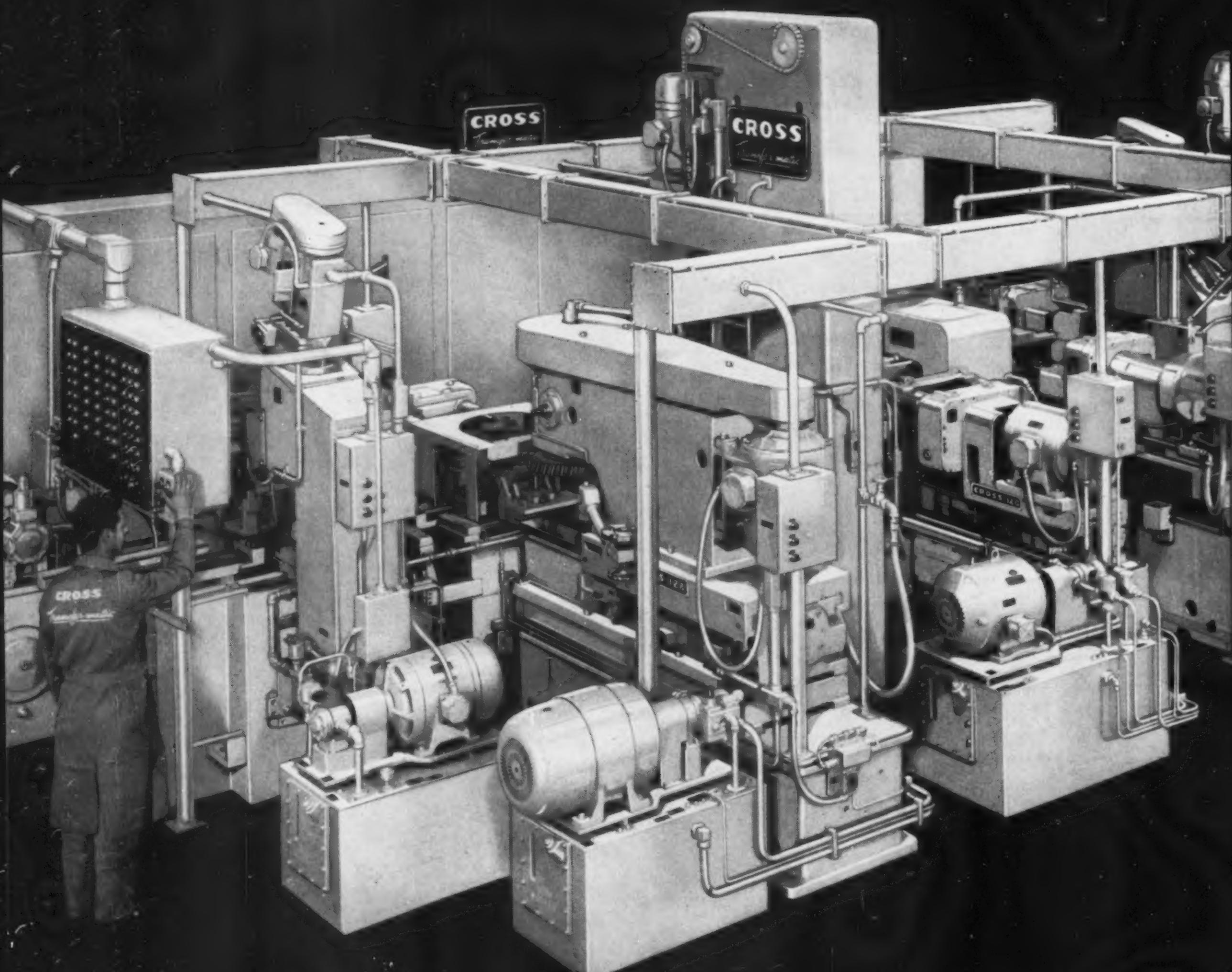
Work Loading Alignment is never disturbed by wear of either grinding or regulating wheel . . . neither is the alignment of the work rest blade. Movable heads for both grinding and regulating wheels make this advantage possible . . . and especially time-saving in a battery set-up.

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

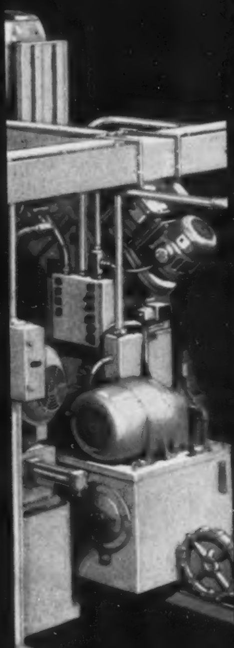
For more data, circle this page number on inquiry card

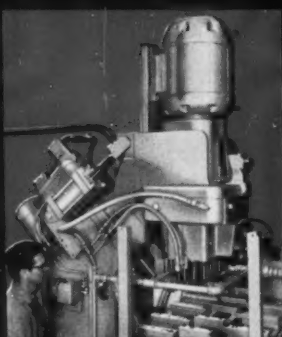
New Cross Transfer-matic Developments Reduce Machine Down Time Problems



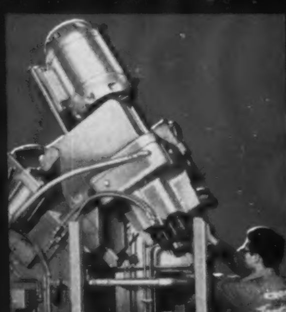
PART: Crankcase assembly.
OUTPUT: 128 pieces @ 100%.
OPERATIONS: Milling, drilling, reaming and tapping.

The cutter changing mechanism overcomes problems usually encountered where heavy, large diameter milling cutters are mounted on vertical spindles.
The head is a standardized Cross adjustable spindle "building block" unit for heavy duty production milling.





As shown above, the "swivel head" is in operating position. For changing tools, the head is "swiveled" by a manually controlled hydraulic cylinder as shown below.



More Automation Progress by Cross

Innovations For Greater Accessibility, Faster, Easier Tool Changing and Electrical Trouble Shooting

Several new design developments in this Cross Transfer-matic for machining 6-cylinder, aluminum crankcase assemblies contribute significantly to reduced predictable and unpredictable machine down time for tool change and electrical trouble shooting.

LESS PREDICTABLE DOWN TIME: A cutter changing mechanism on the milling head at Station 4 handles the cutter for the tool set-up man, speeds up cutter replacement, prevents blade chipping and promotes safety.

In the final station of the machine, a new "swivel mounting" arrangement is employed on a 19 spindle tap head. For changing tools, the head is swiveled out of the work area thus providing maximum accessibility for easier, fast tool changes.

LESS UNPREDICTABLE DOWN TIME: Electrical trouble shooting on this machine is greatly simplified by another new Cross development—integral machine unit push button-terminal stations. All terminal wiring formerly located in the wing base has been combined in the push button panel. By removal of all wiring from inside the wing bases, unpredictable electrical failure from exposure to coolants and moisture in the base is prevented and accessibility minimizes downtime for trouble shooting.

To prevent scratching and scuffing of the locating surfaces of this aluminum part, a lift and carry mechanism is employed.

Cross "building block" construction permits economical conversion as part design changes occur.

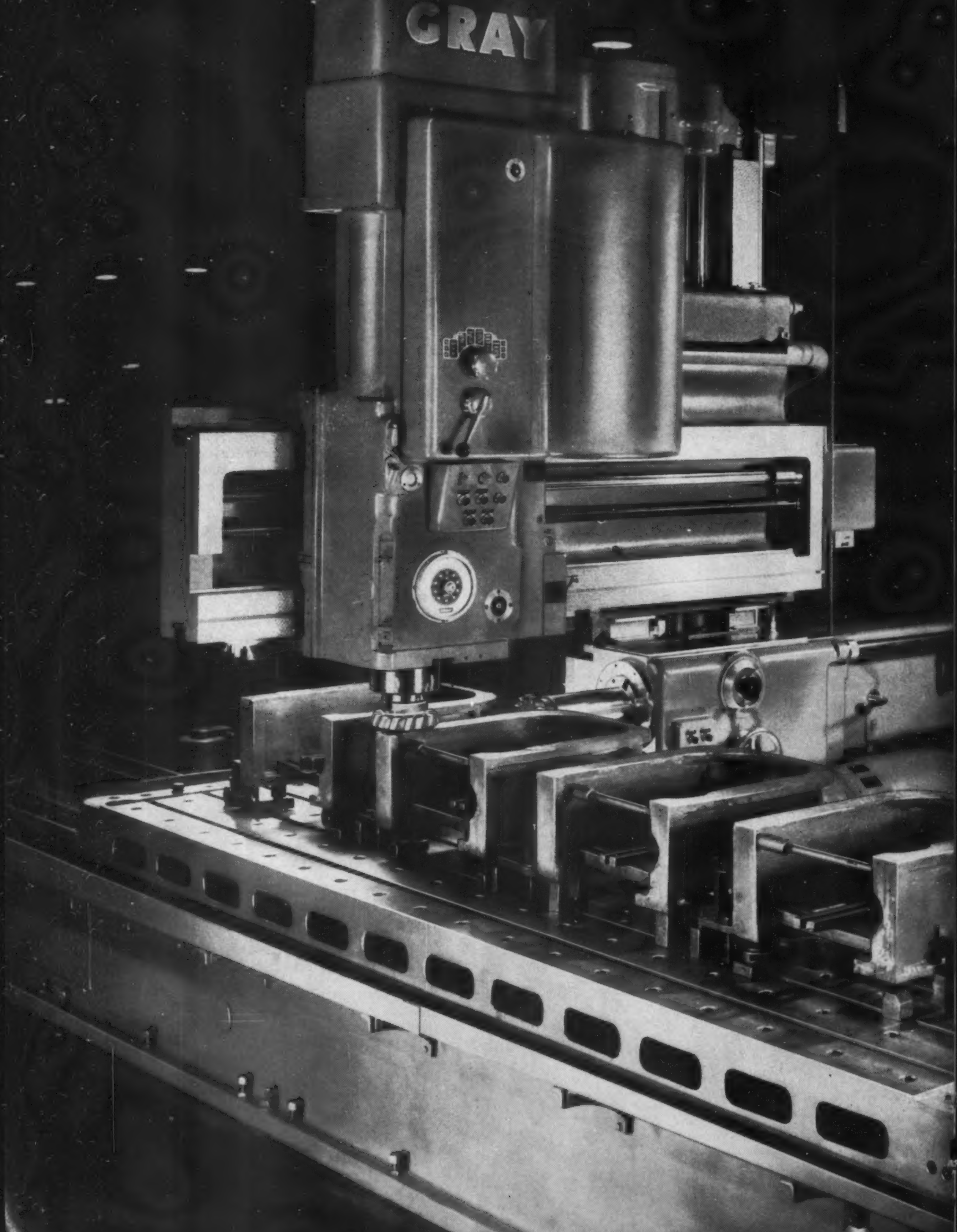
In your next tooling job, make Cross Transfermatics your first choice for production milling, drilling and boring operations.

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN


GRAY

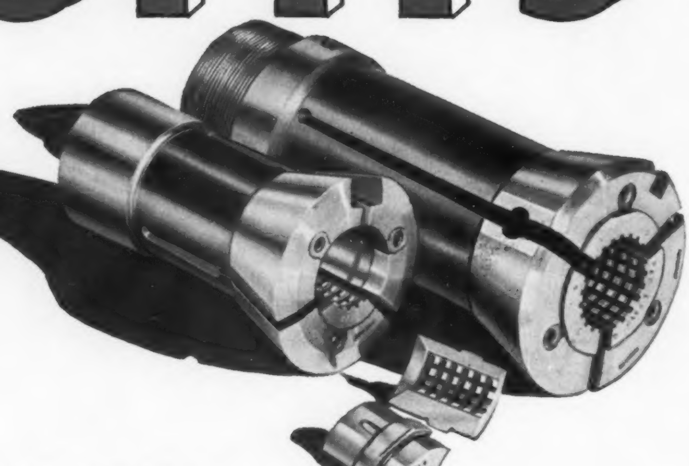
HARDINGE
ELMIRA, N.Y.

MASTERS and PADS

FOR BETTER PERFORMANCE — BETTER PRODUCTION

AND

PROFITS



STYLE "S"
MASTER COLLETS and PADS
The Only Master Collet with
No Work Pressure On The Screw
Available For: Cleveland-Cone
Greenlee—Gridley and Acme-Gridley
National Acme—New Britain
Warner & Swasey

Write for FREE Bulletins

STYLE "B"
MASTER FEED FINGERS and PADS
Pads Cannot Work Loose
No Screws — No Pins
Available For: Brown & Sharpe
Cleveland—Cone—Davenport—Greenlee
Gridley and Acme-Gridley—National Acme
New Britain—Warner & Swasey

Carried in Stock For Prompt Delivery at:

Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia, Seattle, Portland, Minneapolis, Oakland, St. Louis, Toronto

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

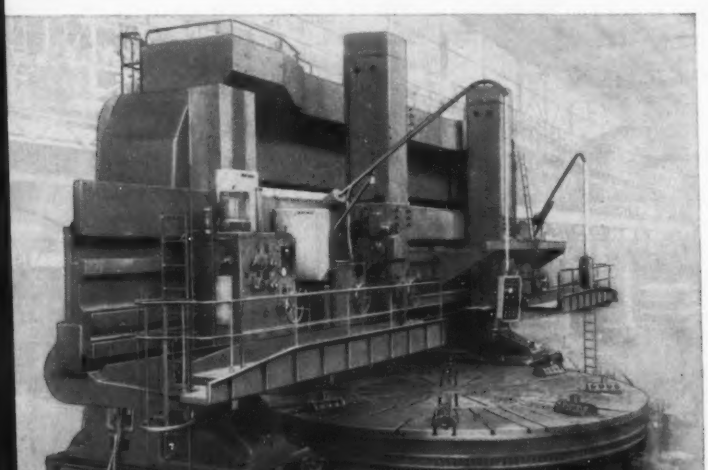
watch these giant workers chip away costs!

This 8⅞ in. SCHIESS model BF horizontal boring and milling machine . . .
now completely redesigned with many innovations. Here are a few . . .

Two individual drives—gear-drive for roughing, belt-drive for finishing. Belt-drive particularly suited to high-speed machining with carbide tools. New tool clamping device—does away with draw keys, hammers, drifts and binding screws. All spindle-slide movements controlled from easily accessible operating platform (or from pendant station or portable control panel, if desired). Special main-drive belt requires no readjusting. Column, spindle-slide and boring spindle may be adjusted at rapid traverse.

Spindle diameters, 6-5/16″ to 8-7/8″. Maximum diameter bored, 59″—faced, 79″.

It takes Europe's largest builder of heavy machine tools, Schiess, to turn out giants like these. Parts and service as close as Pittsburgh. And an American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all Schiess BF and K models.



This 32 ft. SCHIESS model GK vertical boring and turning mill . . .
Look at all these new features of the most modern vertical boring mill of its type: Two ram heads on the rail, one of which is tracer-controlled. One milling head on the rail which can be parked on the left side rail extension. Dual tables—one 15′ table on the inside, a 32′ table on the outside. Each table has independent drive, or both tables can be used together and synchronized as one. Table equipped with indexing device to be used for indexing layout work. Machine will swing a maximum diameter of 40′. Rapid traverse motions with pushbutton control of changeover from feed motion to independent power traverse. Electro-mechanical locking of cross-rail to columns. Fingertip speed control—counter-balanced cross-rail and side-head—completely enclosed swiveling octagon rams—pendant control—automatic lubrication.

Have you ever seen anything like it?

For more data, circle this page number on inquiry card

SCHIESS

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

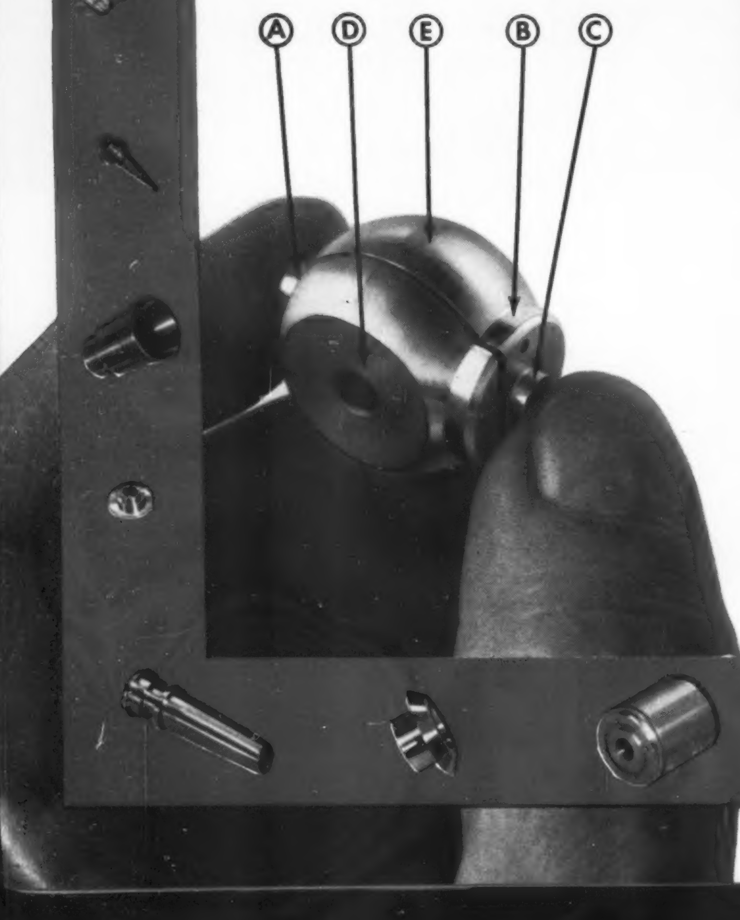
For productiveness in the toolroom

MONARCH YEARS-AHEAD

Versatile as they come

The same basic machine is offered in two standard forms—with screw-cutting equipment as a Toolroom Lathe—without screw-cutting features, as a Manufacturing Lathe. Such additional items as the following improve productivity and enhance versatility.

Air-Gage Tracer
Automatic Cycling
Hydraulic Turret
Steady Rest
Follow Rest
Taper Turning Attachment
Collet Attachments
Air Equipment
Bar Feed Attachment



PRECISION PERFORMANCE

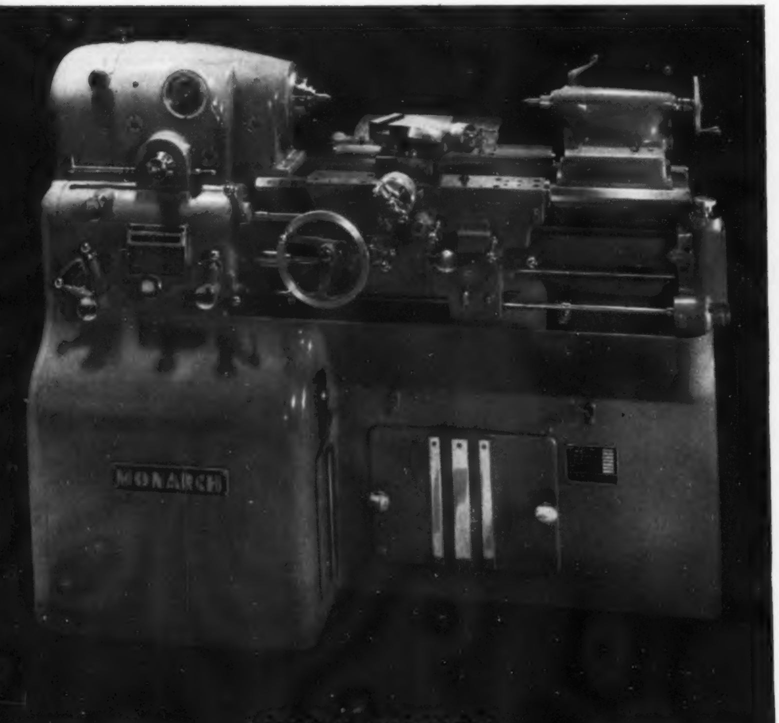
Here's a beautiful example of turning as both a science and an art. Just consider typical tolerances on this miniature gyro gimbal housing:

1. *Diameters A, B, C, E on same center line within .0002" T.I.R. and square to bore D within .0005" T.I.R.*
2. *All outside diameters concentric with inside diameters within .001" T.I.R.*
3. *Wall thickness E .030" ± .001"*
4. *Diameter A + .0002"; — .000"*
5. *Diameter C + .0005"; — .000"*

These units are externally and internally tracer turned to the above tolerances by Vee-Arc Corporation of Westboro, Massachusetts. Air-Gage Tracer equipped Monarch 10" EE Lathes are used—in conjunction with Vee-Arc Super-Precision Live Centers which are accurate within .000020" T.I.R.

for toolroom accuracy in production!

10" MODEL EE PRECISION LATHES



with many refinements PLUS 2 more horses

Any Model EE user will tell you it has long been the lathe of tomorrow. Now it's an even better machine with more power, more convenience, more productiveness.

For precision turning, boring, facing and threading in the toolroom this lathe has no equal. It's fully as proficient for such super-accurate manufacturing operations as required for small jet, missile, instrument, electronic and camera components.

Check the listing of major features; take a look at the job report and the many typical parts turned on this machine. Then, put it up to us to show you how the 10" EE can solve many of your turning problems with EEse.

THE MONARCH MACHINE TOOL COMPANY,
Sidney, Ohio.

If it can be turned
there's a Monarch to do it
better and faster

MAJOR FEATURES

- *5 H.P.* drive direct to spindle through multiple "V" belts, providing an infinitely variable speed range. No gears in the headstock.
- Standard speed range, 5 to 3000 R.P.M.; optional range, 6.5 to 4000 R.P.M.
- D.C. variable speed motor secures its power through an electronic unit which utilizes almost any source of A.C. This type of power supply minimizes vibration at all speeds, practically eliminates noise, improves speed regulation regardless of load and maintains better torque at the lower speeds.
- Spindle comes to dead stop in less than 2 seconds, attains full speed in less than 3 seconds.
- Automatic lubrication throughout.
- American standard Camlock spindle nose—for quick, rigid and accurate chuck and fixture mounting.
- Wide range of threads and feeds through totally enclosed gear box and end gearing.
- Cross feed and leadscrews induction hardened and ground.
- Flame hardened and precision ground bed ways for both carriage and tailstock. Bed all in one piece—no inserts.
- Easy, fatigue-free operation. Base design permits operator to work close comfortably, from standing or sitting positions.
- The only small lathe available with anti-friction bearing taper attachment.
- For thread chasing up to 100% faster, is available with exclusive combination of electric leadscrew reverse and variable reverse speed control.

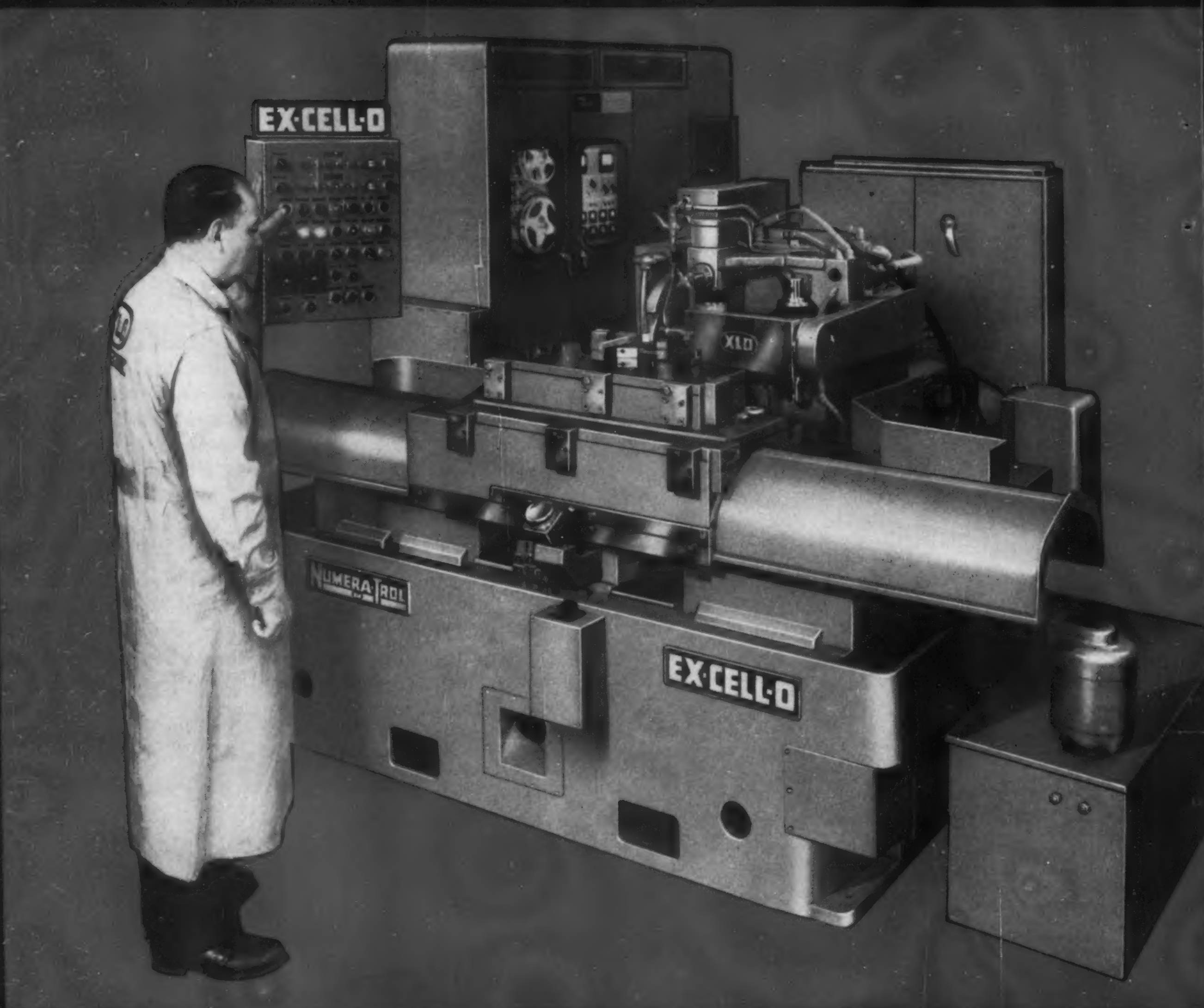
Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

PERFORMANCE REPORT

R. J. Huff, Granite City maintenance superintendent, points out Morgoil bearings to J. H. Koester, Granite City lubrication engineer, and W. P. "Sandy" Wehking of Standard Oil.

How *STANOIL* *Industrial Oil* has been delivering on 22-year assignment at Granite City Steel

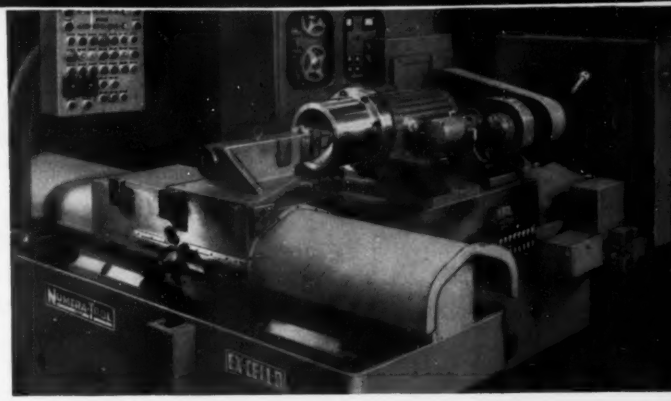
Bearing assembly viewed from inside by J. H. Koester and Sandy Wehking. Sandy Wehking knows industrial lubrication. For 17 years he's been providing lubrication technical service to industrial customers. He studied chemistry at Blackburn College and has completed the Standard Oil Sales Engineering School.



EX-CELL-O
XLO
NUMERA-TROL
EX-CELL-O

Standard Numera-Trol 922 equipped with grinding unit for precision templet grinding. Grinding assembly is easily interchangeable with boring and turning unit for accurate contouring operations.

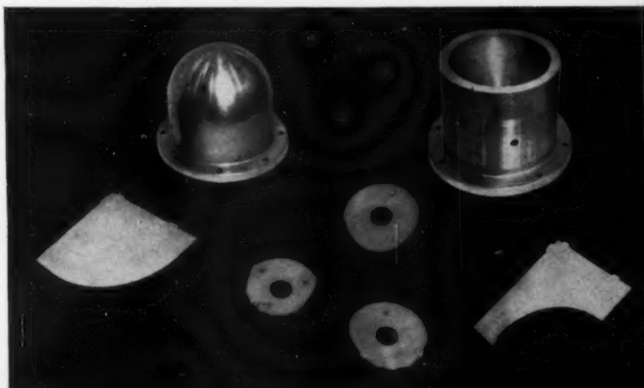
Machine is equipped for contouring by mounting boring and turning unit on main slide and tool holder on cross slide. Spindle speeds are automatically varied to maintain constant cutting speeds.



Operation is monitored by electronic "Nixie" counting tubes and by direct-reading optical vernier. This mechanical and electronic read-out combination gives "closed loop" accuracy control during all operations.

Numera-Trol Contouring Machine simplifies production of parts with complex contours, ends need for blueprints and models, permits fabrication of prototypes and production parts directly from designer's mathe-...atical directions.

By setting dial and pressing button either slide can be moved in increments ranging from .000025" to .10" with total movement of 18" on main slide and 26" on cross slide.



with the world's most accurate production machine tool!

EX-CELL-O NUMERA-TROL

XLD

59-71

FREE— NUMERICAL CONTROL GUIDEBOOK

"A Guidebook to Numerically Controlled Machine Tools," a valuable addition to your technical reference library, is available without cost from your local representative, or by writing direct to Ex-Cell-O.

XLO EX-CELL-O FOR PRECISION

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

New, high-tensile steels require special care when welding.

Submerged arc welding gives the most reliable performance with T-1, but . . . most conventional, submerged arc equipment is impractical for one-of-a-kind jobs . . . like a 28 cubic yard bucket.

That's why Peabody Coal Company used a "Mechanized Squirt Welder". The "Mechanized Squirt" gives the user all the control and high quality of completely automatic submerged arc welding without the need of expensive fixtures.

Mechanized "Squirt" simplifies T-I steel fabrication...

RESULT: Peabody Coal welded the T-1, firebox-grade steel at speeds up to four-times faster than manually, with the "Mechanized Squirt Welder" and got perfect welds with L-61 electrode and Lincoln alloy flux.

For complete details on the "Mechanized Squirt Welder" write to us for Bulletin 5205.1.

LINCOLN
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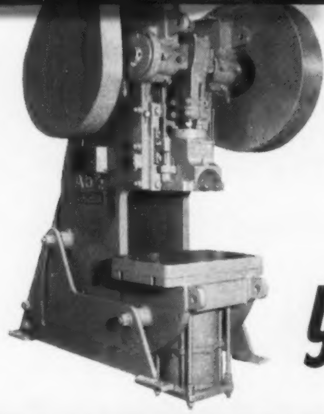
THE LINCOLN ELECTRIC COMPANY
Dept. 1238 • Cleveland 17, Ohio

world's leading manufacturer of arc welders and electrodes, ac motors and battery chargers



for grass roots economy you just can't match this OBI

Cold, hard statistics leave no doubt. Wherever performance data and cost records are compared, the Series A Inclinable is way out front in parts produced per dollar expended.

On the most demanding jobs . . . where the clutch is engaged and disengaged at every press stroke . . . where three-shift operation continues day after day . . . *no OBI can even approach it in thrifty operation, fool-proof simplicity, and safety.* Readily understandable are the reasons why:

Niagara's famed, multi-point mechanical sleeve clutch picks up the load on 14 engaging jaws, applying the driving force concentrically without keys or pins. Instant engagement and maximum productive strokes per minute are assured.

There are no complicated electrical circuits, relays, limit switches or solenoids . . . no palm buttons, air valves or rotary air connections. In fact no air is consumed.

With fewer parts and simpler construction, there's less to go wrong, less to repair or replace. As a result, this is not only a more economical press to operate, but a much safer press as well. Records of thousands of presses are factual proof that the Niagara mechanical sleeve clutch is unequaled in safety and reliability.

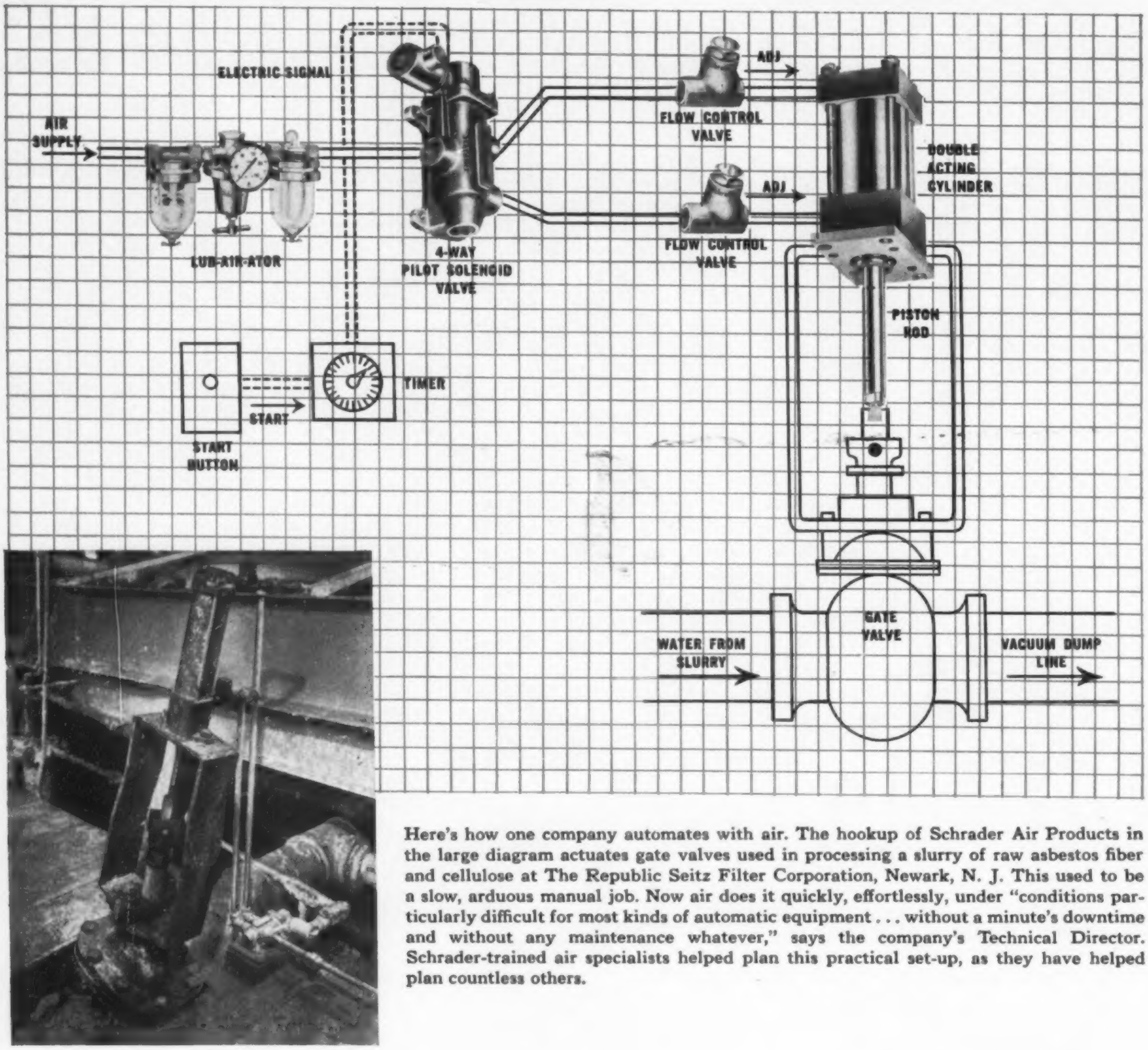
Built in 13 standard sizes, with shaft diameters from $1\frac{1}{4}''$ to $6\frac{1}{2}''$ and capacities from $5\frac{1}{2}$ to 190 tons, Niagara Series A Presses can be readily equipped with numerous accessories for individual requirements.

GET THE FACTS AND FIGURES. WRITE FOR NEW BULLETIN 58N

NIAGARA

NIAGARA MACHINE AND TOOL WORKS · BUFFALO 11, N. Y. District Offices and Distributors Everywhere

PROCESSOR SPLITS PRODUCTION BOTTLENECK WIDE OPEN WITH HOOKUP OF STANDARD SCHRADER AIR PRODUCTS



Here's how one company automates with air. The hookup of Schrader Air Products in the large diagram actuates gate valves used in processing a slurry of raw asbestos fiber and cellulose at The Republic Seitz Filter Corporation, Newark, N. J. This used to be a slow, arduous manual job. Now air does it quickly, effortlessly, under "conditions particularly difficult for most kinds of automatic equipment . . . without a minute's downtime and without any maintenance whatever," says the company's Technical Director. Schrader-trained air specialists helped plan this practical set-up, as they have helped plan countless others.

Boost productivity of even complex operations quickly and economically, like this company . . . with *air!* Plan it yourself, or let our experts help. A system of Schrader Air Products can simplify almost any bottleneck job . . . whether it's processing, assembling, testing or packaging . . . pushing, pulling, holding, positioning or moving work repetitively.

With Schrader Products, you can run practically any production line faster, safer, more economically—and with tireless accuracy! Maintenance is surprisingly low.

These are benefits every shop needs. Take advantage of them all when you automate with Schrader . . . the finest, the most complete line of Air Cylinders, Valves and Accessories . . . plus countless ideas for cutting your operating costs.

Select air controls from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data, write:

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QUALITY AIR CONTROL PRODUCTS

PRODUCTION POINTERS from GISHOLT

MASTERLINE GISHOLT SINCE 1887

FIVE FASTERMATICS SAVE 46% ON PANHARD AND LEVASSOR "PL17" CRANKSHAFT ARMS

Fixtures, smart tooling and machine features simplify work on tough steel forgings

Fixture work giving you headaches—in lengthy machining times, high tool costs and excessive reject rates? You may find some new answers by checking this setup at Panhard and Levassor Automobiles, Paris, France, plant.

Nine semi-automatic lathes were used to produce a wide variety of steel crankshaft arm forgings in lots of 500 to 1000 pieces. Time cycles were lengthy. Parts were hard to hold and machine, and consistent quality was a problem. As a part of its quality improvement and modernization program, the firm investigated various other methods.

Gisholt MASTERLINE 1F Fastermatic Automatic Chucking Turret Lathes, with smart fixturing and standard tooling, were found to best meet this company's needs for consistent quality, versatility, quick setup and lower production costs.

For the first operation on a typical part, framed at left, below, the rough forging is placed in a special chucking fixture. This fixture is adjustable for all sizes of parts. Jacks locate longitudinally. The counterweight rests in a stationary V-block, locating for height. A V-shaped centralizing jaw grips from the opposite side. Two additional jaws, at the left and right, also grip the work.

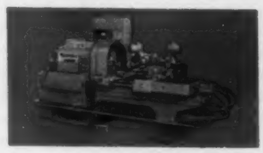
The heavy black surfaces on the drawing are machined from the hex turret. Facing of the hub, the counterweight and thrust bearing surfaces, shown in red, is handled from the front and rear cross slides. Floor-to-floor time is a fast 5.2 minutes.

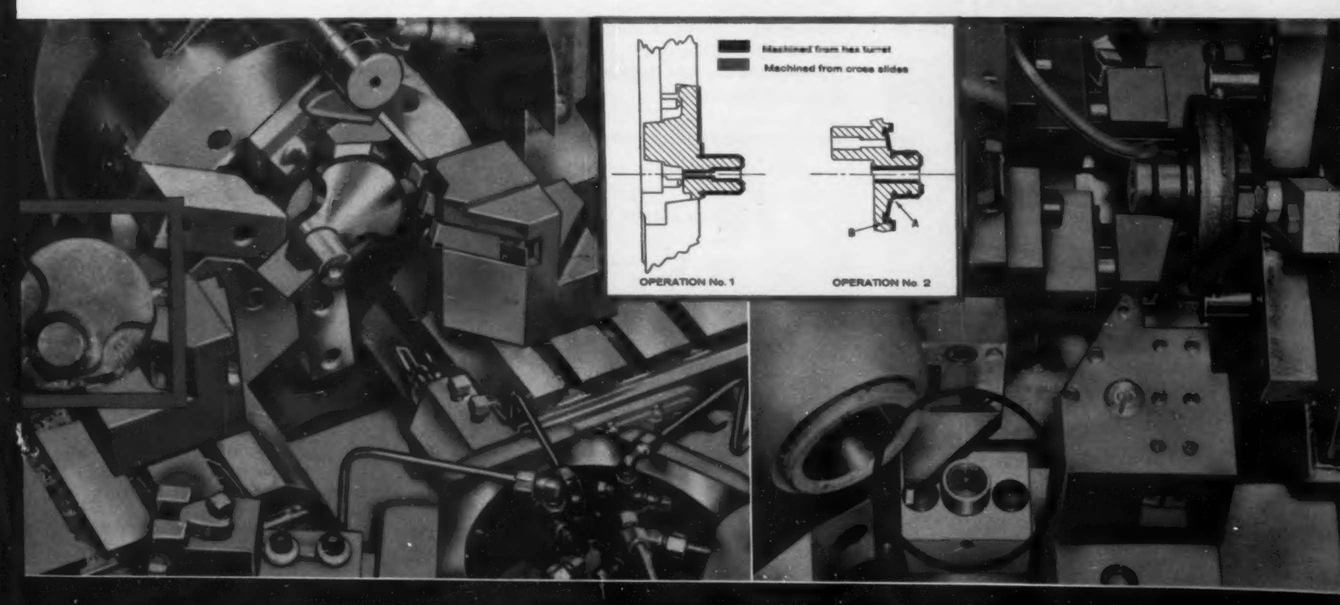
The second operation on a second 1F Fastermatic completes the opposite or crank end of the part. Work is chucked and located on previously machined surfaces. Front and rear cross slide tools face the crank end, the outer edge of the flange, and form one groove as shown in red on the Operation 2 drawing. All other machining handled from the hex turret is shown in black.

The grooving operation on Surfaces A and B is worth remembering. It is handled by two tools, in a cam-operated, turret-mounted, facing slide tool. Tool clearance problems are solved by an angle cam, mounted on the slide tool. Forward movement of the hex turret saddle engages the angle cam with a roller bearing on the rear cross slide top (encircled at lower right). Continued forward movement of the turret saddle forces the slide tool to move transversely, engaging one tool on each side of center. Reverse of the hex turret saddle at the end of the cut provides automatic tool relief. Floor-to-floor time for this operation, 4.9 minutes.

Five 1F Fastermatics replace nine older lathes. Savings include 46% less machining time, 40% less change-over time, 15% longer tool life. Surface finish is improved and closer tolerances are held. Productivity is increased, too, because the automatic machining cycle permits each operator to handle two machines.

For complete facts on 1F Fastermatics, circle No. 1751 on inquiry card.





GLOBE OIL TOOLS THREADS 580% FASTER ON 28Rc STEEL ASSEMBLIES

One CRI-DAN "E" replaces four lathes, ups total production from 48 to 70 parts per day

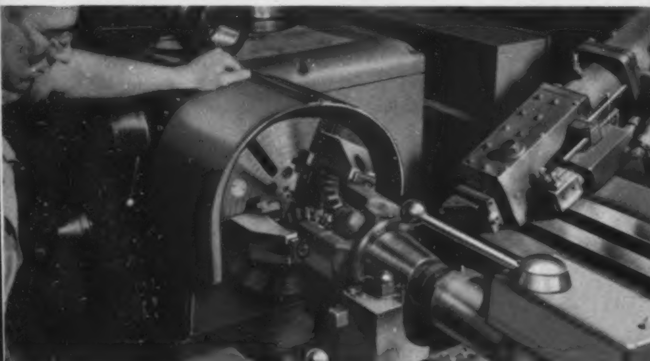
Are you using thread grinders, thread millers or hand-operated lathes to perform threading operations on hard materials or tough jobs? You can probably make substantial savings in original equipment and tooling costs, and improve production rates as well, with the modern CRI-DAN method. Low-cost, single-point carbide tools, easily sharpened or replaced, are used to produce all types of threads to highest accuracy and finish. Higher speeds and feeds may be used. The automatic threading cycle assures repeat accuracy and, in many cases, permits the operator to perform additional work for added savings.

This setup at Globe Oil Tools Company, Los Nietos, California, is worth careful study. It shows you an easy way to cut costs, up production, and maintain the accuracy and fine finish you require in threading operations.

Previously, Globe Oil Tools used four engine lathes to machine the tapered threads on the pin ends of oil well rock bit assemblies. A typical, 8¾-size part is shown below.
Highly skilled men were needed to meet the accuracy and finish requirements of these hard-working parts. Production averaged 12 pieces per day, per machine, at 80% efficiency.

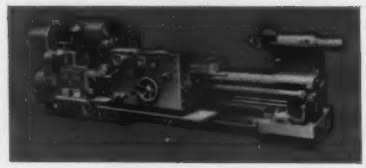
Now, with the setup shown on a CRI-DAN "E" Threading Lathe, production has increased to 70 parts per day at 80% efficiency. The automatic cycle reduced the operator's work to loading, starting the cycle, gaging, and removing the completed part. It allows him time to handle pre-threading operations on another automatic.

Work is gripped in a 3-jaw air chuck, locating against turned shoulders on each of the three segments of the welded assembly. The 4½ API, .117″-deep thread on the 8¾-size part shown is completed in 26 passes at 385 r.p.m. Tool "in-feed" is set to diminish with each pass—starting at .007″ and removing only .00175″ on the final pass. This assures highest accuracy and an extremely fine finish. A rear-mounted auxiliary slide bevels and faces the standoff shoulder, and relieves the threads at the large end. Threading time is 2.5 minutes.



Tough, 28Rc welded steel forging assemblies are threaded 580% faster using the CRI-DAN single-point carbide tool threading method. One CRI-DAN "E" replaces four engine lathes. CRI-DAN operator has time to handle another automatic.

For complete information on CRI-DAN "E", circle No. 2751 on inquiry card.



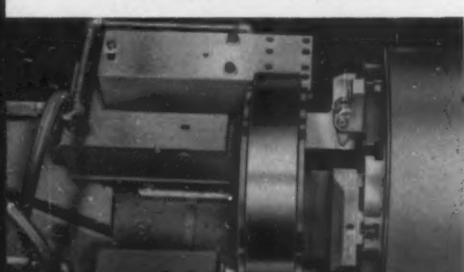
SPROUT, WALDRON & COMPANY HANDLES SMALL LOTS 400% FASTER

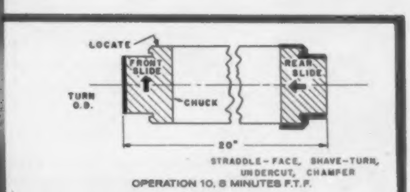
Versatile tooling, fast change-over on Simplimatic save on big parts

You may be paying premium rates to produce small lots on manual machines. Here's what happened when Sprout, Waldron & Company, Inc., Muncy, Pennsylvania, replaced two older lathes with one Gisholt MASTERLINE Simplimatic Automatic Lathe. Machining time was cut 400% on over 12 different sizes of forged steel pellet mill dies and roller shells. These are produced in lots of 20 to 100, and are used for compacting and densifying animal feeds, free-flowing plastic and chemical products.

The wide platen table of the Simplimatic provides maximum flexibility for placement of tool slides. Tools and tool blocks are designed for quick adjustment or replacement. Chuck jaw inserts accommodate different diameters. Complete change-over to different sizes on the same operation averages 20 to 25 minutes.

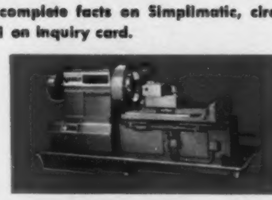
The first operation setup for a 20″-diameter, 5″ Simplex die is illustrated. Note the pivoting locators on the chuck, swung aside to permit machining front and back surfaces simultaneously. Table traverse positions the tools and standard slide movement is used to machine. The line drawings show the surfaces handled by the front and rear independent slides in two operations.





Quick setup and fast cycle handle big pellet mill dies 400% faster. Simplimatic replaces two older machines—eliminates all overtime and night-shift premium for these operations. Smart tooling reduces inventory requirements. Automatic cycle permits operator to do other work for added savings.

For complete facts on Simplimatic, circle No. 3751 on inquiry card.



ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

MASTERLINE GISHOLT SINCE 1887

HOW POWERS REGULATOR CO. IMPROVES DIMENSIONAL CONTROL ON VALVE BODIES

No. 5 Ram with indexing chuck and auxiliary stop completes four ends per chucking

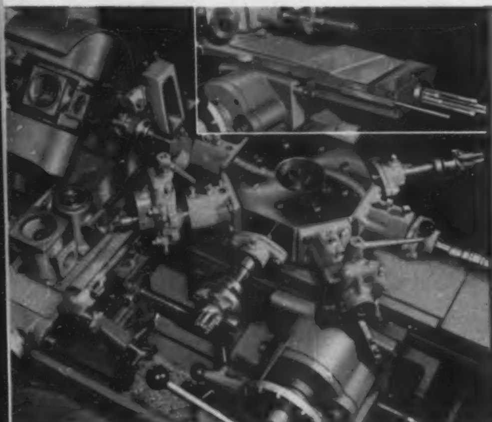
If your work involves tees, ells or crosses, you'll get some cost-cutting ideas from this setup, used by Powers Regulator Company, Skokie, Illinois. It assures concentricity, parallelism and highest accuracy by completing all four ends of brass valve bodies in one chucking.

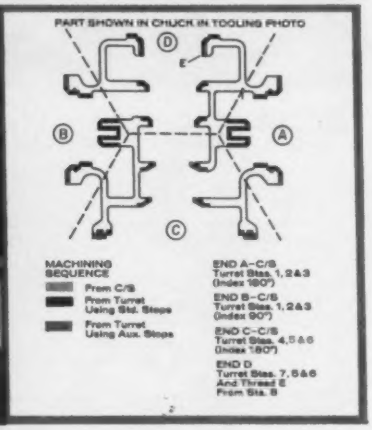
The basic setup on a Gisholt MASTERLINE No. 5 Ram Type Turret Lathe, shown below, handles three different sizes of parts. Four factors are responsible for improved dimensional control and reduced time on this job:

1) A 15", 2-jaw, air-operated, indexing chuck—that completes all four ends in one chucking.
2) An Octagon turret—with hollow mills and multi-diameter cutters to machine maximum surfaces per pass.
3) A retractable auxiliary stop for the turret ram, shown inset. Despite eight turret stations, all surfaces could not be completed. The answer—the standard ram stop roll to control length of cut on one end—an auxiliary stop to control length of cut on the opposite end—on stations 5 and 6.
4) "Tenth" indicator for speedy cross-slide setting.

The drawing and machining sequence data, left, shows how the special tooling is used. F.t.f. time on the part shown is 9.8 minutes.

If you are handling similar work, with two or more ends to be machined, circle No. 6751 on Inquiry Card for information on the Gisholt MASTERLINE Ram Type Turret Lathe and Gisholt Indexing Chucks.





THOMPSON RAMO WOOLDRIDGE INC. CUTS FINISHING TIME, IMPROVES QUALITY ON GEARS

Superfinish corrects part geometry, provides smoother surface for greater operating efficiency

Looking for an economical way to obtain flatter, smoother, longer-lasting wear surfaces? Then study this Superfinishing setup used by Thompson Ramo Wooldridge Inc., Fuel Systems Works, Tapco plant, Cleveland, Ohio.

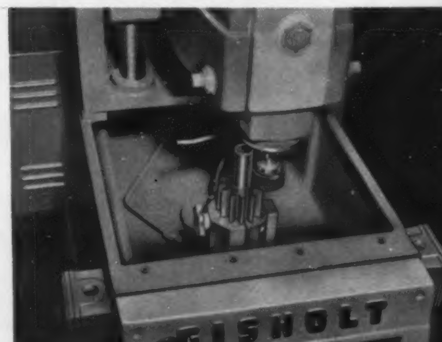
The workpiece, an aircraft fuel pump gear, is used to pump kerosene and gasoline. It requires a very flat, low micro-inch surface finish for most efficient operation. Here's how a Gisholt MASTERLINE Model 81 Superfinisher meets this requirement economically on four gear sizes.

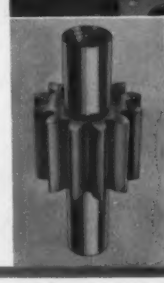
Work is placed in a special fixture against an adjustable stop. On engaging the stop, the workpiece is given a counterclockwise turn to lock it in the fixture. The Superfinishing stone is then engaged. Stone pressure holds the work securely during the operation.

The work and the Superfinishing stone rotate in opposite directions. Some stock is removed during Superfinishing to correct surface geometry and provide the required flat face. Surface roughness is reduced to a "controlled" 1.5 micro-inches R.M.S. Cycle time for one face of the work is 1.5 minutes. To Superfinish the opposite face, the operator removes the part by twisting it clockwise, turning it end for end and repeating the operation. Total time for both faces is three minutes, f.t.f.

Superfinish eliminates grinding defects, improves surface geometry, exposes true base metal for longer surface life. Fixture permits completing both pump gear faces to required accuracy in minimum time.

For complete facts on Model 81 Superfinisher, circle No. 7751 on inquiry card.





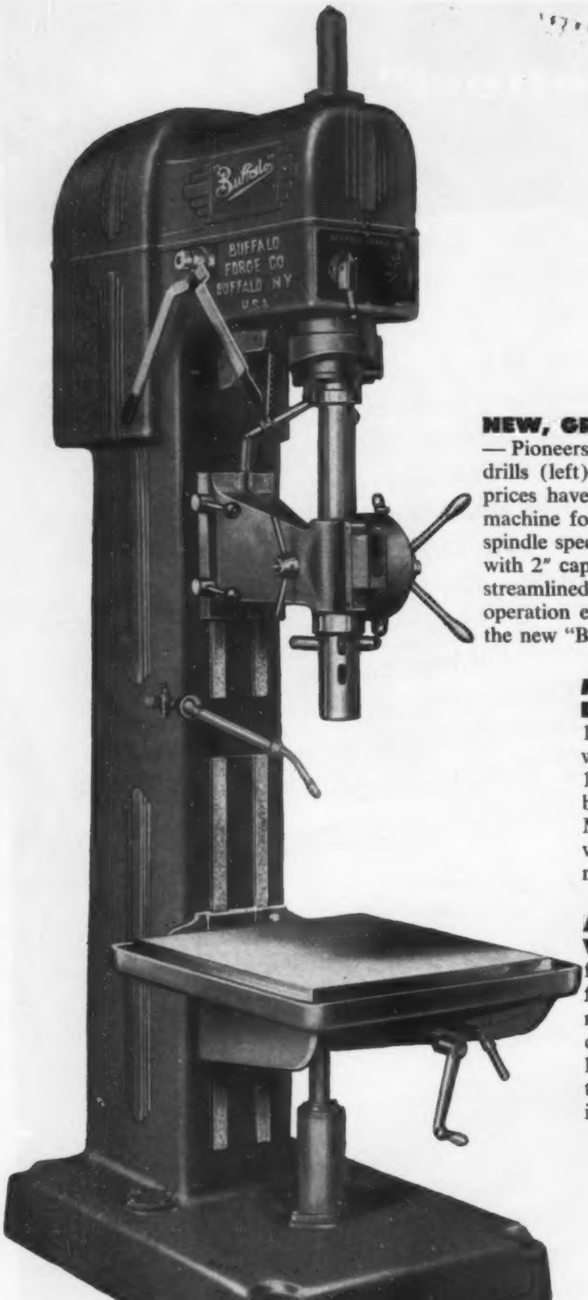
No. 11-1259
751

Printed in U.S.A.

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products



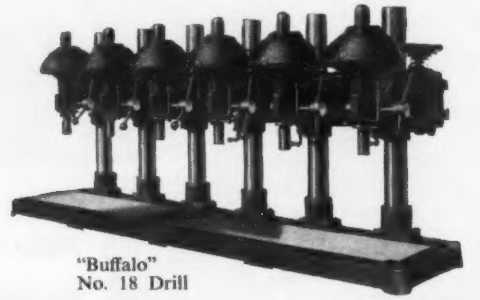
"Buffalo" R-P-Mster

WHICH OF THESE
BELONGS IN

NEW, GREATER CAPACITIES IN THE LATEST "R-P-Msters" — Pioneers in variable speed drilling machines, "Buffalo" "R-P-Mster" drills (left) are newly redesigned to bring you greater capacities. And, prices have been revised to bring you a pleasant surprise! This is the machine for high-speed, accurate production drilling, providing infinite spindle speed changes between 75 and 1300 RPM in the No. 3A Model with 2" capacity. The new, higher capacity "R-P-Msters" have the same streamlined design, rugged and massive construction and the smoothest operation ever built into a drilling machine. Get the complete facts on the new "Buffalo" "R-P-Mster" Drills. Use convenient coupon.

MULTIPLE OPERATIONS SPEEDED BY HEAVY-DUTY DRILL. Powerful and rigidly-built, the "Buffalo" No. 18 Drill is designed to help operators turn out better, faster work. Operation is simple; adjustments are easy. Choose from 19 models to suit your drilling needs exactly — single spindle bench or floor models and multiple units up to six spindles. Minimum deflection is the result of 6-spline alloy steel spindles which turn smoothly on precision ball bearings. Select the models best fitted to your needs — use handy coupon.

A "STAND-OUT BUY" FOR GENERAL SHOP WORK. The "Buffalo" No. 16 Drill offers you more quality features than any machine in its price range: 4 rates of power feed — 5-speed V-belt drive — hardened tool steel clutch members. These features are bound to lower your production costs — through faster and easier drilling, longest useful tool life and peak accuracy. Available in bench, floor or pedestal types, and in multiple units up to six spindles. For complete information on the "Buffalo" No. 16, mail coupon.



"Buffalo"
No. 18 Drill

ESTABLISHED 1877
"Buffalo"
MEMBER N.M.T.B.A.

BUFFALO FORGE

440 Broadway

Canadian Blower & Forge Co., Ltd.,

DRILLING PUNCHING

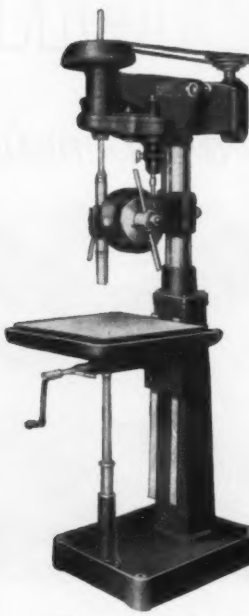
"BUFFALO" DRILLS

YOUR PLANT ?

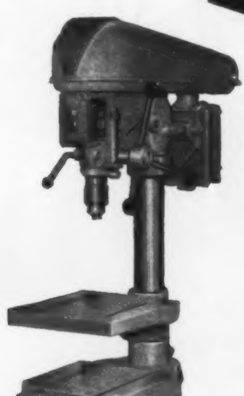
NEW FEATURES MAKE A FINE DRILL BETTER. Reports from users of the new "Buffalo" No. 15 Drill are beginning to come in to us. Owners, shop foremen, operators are all enthusiastic. They like the many design improvements which result in easier, faster operation, flexibility and a minimum of maintenance. Although unusually sensitive, the No. 15 is ruggedly built for full capacity operation without wear or strain. The new line includes bench, floor and pedestal models from 1 to 6 spindles. For complete data on the "Buffalo" No. 15 Drill, check and mail handy coupon.

"Buffalo" No. 22 Drill

HIGH PRODUCTION, COMPLEX DRILLING OPERATIONS PERFORMED FASTER—With batteries of multiple-spindle "Buffalo" No. 22 Drills (above). The operator of each bank can handle 2 to 4 setups with no stopping for adjustments. These husky, 96-inch high machines operate as easily as smaller sensitive drills, yet have a capacity up to 1¼" in mild steel. No wonder operators are enthusiastic — each spindle has both power and sensitive feed; all controls are within easy reach. "Buffalo" No. 22 Drilling Machines can add more profitability to *your* shop operations. Check and send coupon to find out *how!*



"Buffalo" No. 16 Drill



"Buffalo" No. 15 Drill

BUFFALO FORGE COMPANY
440 Broadway • Buffalo, N. Y.

Please send me additional information on the following "Buffalo" Drilling Machines:

☐ **No. 22** ☐ **"R-P-Mster"**

☐ **No. 18** ☐ **No. 16** ☐ **No. 15**

NAME .... TITLE ....

FIRM ....

ADDRESS ....

CITY .... STATE ....

COMPANY

Buffalo, N. Y.

Kitchener, Ont.

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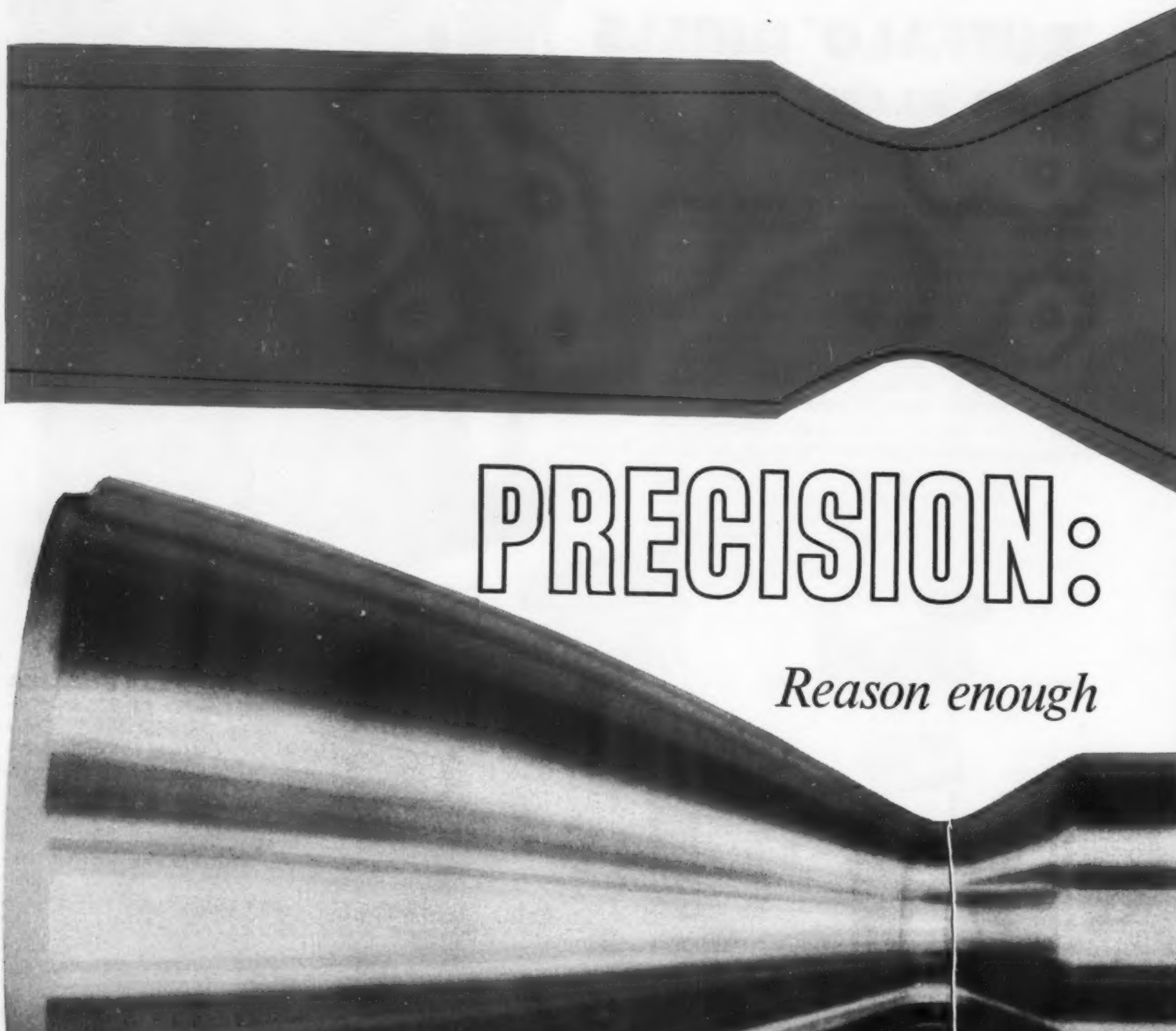
For more data, circle this page number on inquiry card

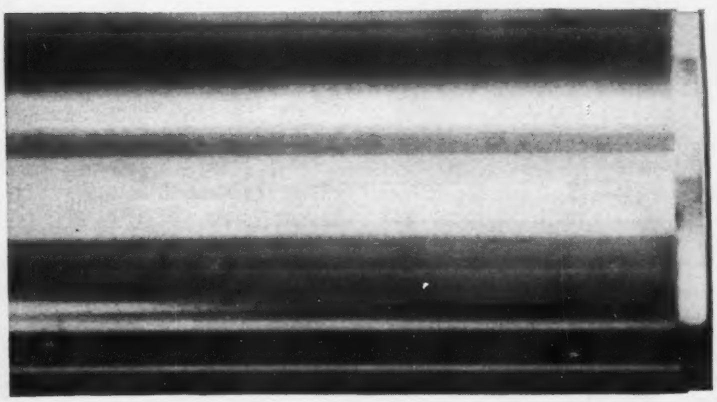

PRECISION:
Reason enough

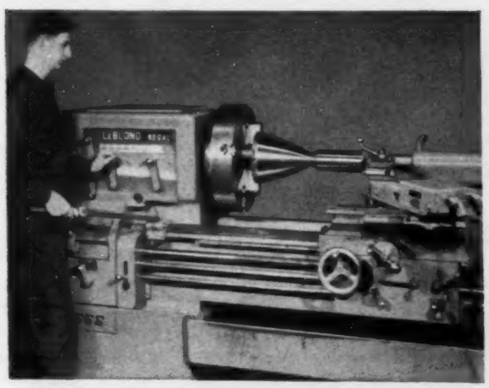
to buy LeBlond

In Hartford, Conn., Delta Corp., specialist in precision fabricating and machining for the aircraft industry, chucks a 350 lb. forging of 347 stainless in its new 24" LeBlond Regal Lathe. When this missile job comes off the tracer-equipped Regal, it will be a contoured tube weighing only 18 lb. Its walls will vary from $\frac{1}{8}$" to $\frac{1}{16}$" according to a rigid and complex pattern. Wall thickness will be held to $\pm .003$", ID to $-.001" +.000"$, OD to $\pm .008$", and finish will be 20 to 30 rms. If the job is run 3 or 30 times, the same precise result will be achieved.

Dependable precision, like this, is reason enough to buy a LeBlond. And Delta Corp.'s new 24" Regal backs it up with the versatility of spindle speeds from 18 to 1080 rpm, the capacity of 26" swing over the bed, the reassurance of 10 hp at 1800 rpm, the repeatability of Hydra-Trace.

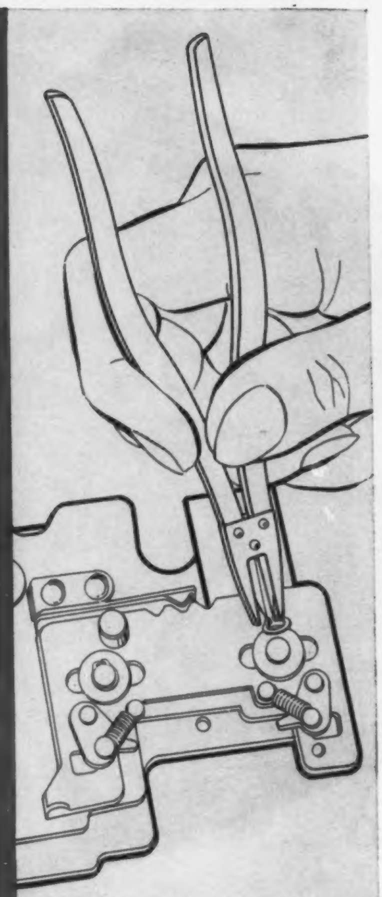
People expect precision with extras from the world's largest builder of a complete line of lathes (and of tracers for lathes, too). They have a right to. It's why they buy LeBlonds.





THE R. K. LeBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LEBLOND
of Cincinnati



Truarc Pliers speed assembly of tiny retaining rings on production line at Viewlex, Inc. Rings are installed on shafts .188" diameter.

Truarc rings eliminate rejects, cut assembly time 40%

Production engineers at Viewlex, Inc., Long Island City, N.Y., save time, speed work with Waldes Truarc retaining rings.

On Viewlex Instruct-O-Matic automatic slide projector, the top plate assembly utilizes five Truarc Series 5100-18 external rings to secure the lost motion plate to the base.

Operator above uses Truarc Standard Plier No. 0018 for installation and removal of rings in accurately located grooves, pre-cut before the assembly is made. Precision engineered plier tips grasp tiny rings securely to speed assembly and disassembly. Pliers are pre-set to avoid over-spreading the rings.

The original design of the unit called for shoulder rivets. In addition to requiring a longer stud, the rivets were difficult to control for height consistency. As a result, when the rivets were flattened, binding or looseness between the plates often caused expensive rejects. For maintenance of the unit, it was necessary to scrap the entire assembly.

Use of Truarc rings assures precise seating of the plates and eliminates rejects caused by faulty riveting. Result: an assembly time saving of 40% at Viewlex. Use of Truarc rings may achieve similar or greater savings—in labor, machining or parts—on your production lines. These versatile fasteners come in 50 functionally different types, as many as 97 sizes within a type, 6 metals, 13 finishes.

They replace nuts and bolts, machined shoulders, threaded collars and set screws, bowed washers or springs and cotter pins, and other fasteners and fastening operations. (A wide line of semi-automatic and manual Truarc tools are available to speed ring assembly). For facts on the entire line of rings, tools and application ideas, write for the new Waldes Truarc catalogs: RR 10-58 and AT 10-58. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N.Y. D.15

WALDES

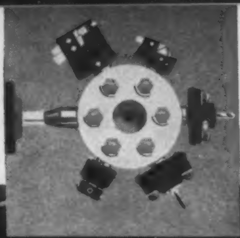
TRUARC®

RETAINING RINGS

Waldes Kohinoor, Inc., Long Island City 1, N.Y.

TRUARC RETAINING RINGS . . . THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS


Brown & Sharpe
PRECISION CENTER
to help you
make more
for less . . .



TO HELP YOU REDUCE SCREW MACHINE PRODUCTION COSTS

Production records prove the new Brown & Sharpe Automatics pay off predicted savings - with a plus

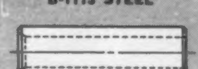
B-1113 STEEL

49% SAVING in production time

With previous equipment 34⅓* Sec. per piece With new No. 2 Automatic 17½

*Includes 22⅓ sec. for secondary operations which are now part of No. 2 Automatic machining cycle.

B-1113 STEEL



54% SAVING in production time

With previous equipment 57¼* Sec. per piece With new No. 2 Automatic 22½

*Includes 2¼ sec. for secondary operation which is now part of No. 2 Automatic machining cycle.

Now, from plant after plant where the new B&S No. 2 Automatic Screw Machines are in the line, reports show that they not only deliver the promised advantage over old equipment, but often provide a substantial plus in extra savings. In many cases — one, two, and sometimes three secondary operations have been eliminated. The need for the extra machines is ended, and total man-hour savings run as high as 90%.

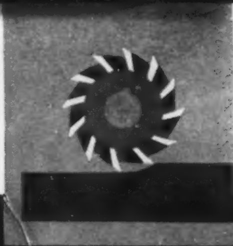
In addition, the new Automatics maintain specified tolerances as close as 0.0005", and meet the highest standards for surface quality.

With such proved production savings, buyers agree that the new Automatics "pay for themselves in record time." Find out how you can make comparable savings with the extra speed and precision — the extra adaptability for combined operations — the faster set-ups and extended tool life.

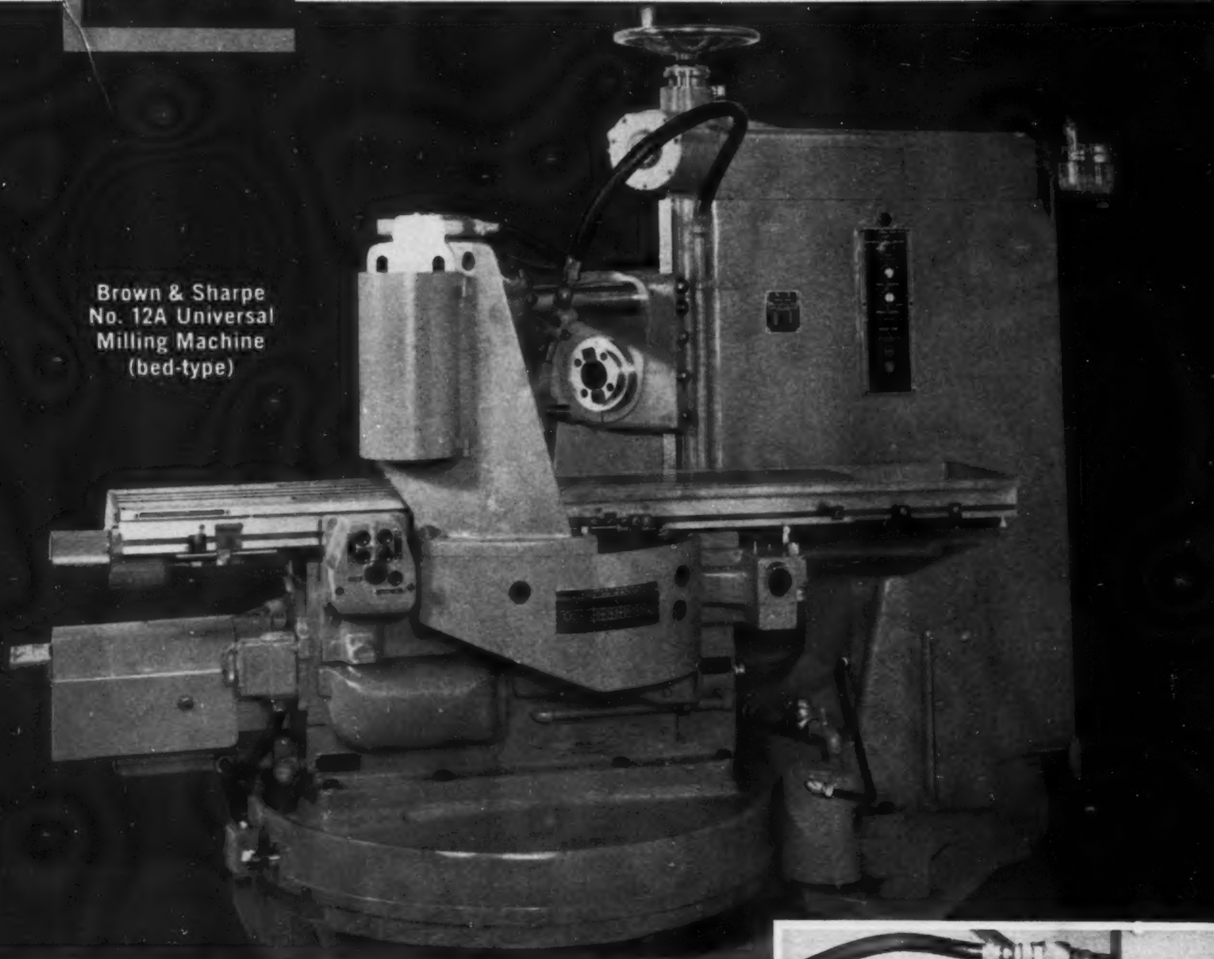
The No. 2 Automatic is made in 3 sizes — to take stock up to ¾", 1¼", and 1½" diameter. For complete details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

For more data on this series of B&S ads circle 43 on card.

Brown & Sharpe BS PRECISION CENTER

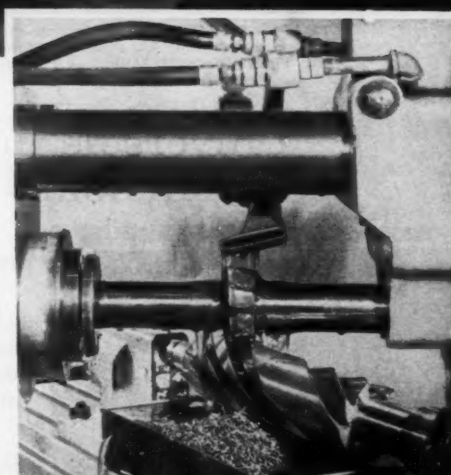


TO HELP YOU MILL MORE FOR LESS



Brown & Sharpe
No. 12A Universal
Milling Machine
(bed-type)

NOW—helical milling with automatic production economy



The No. 12A Universal combines a unique swiveling base arrangement with the powerful cutting ability and automatic control features of the popular Brown & Sharpe bed-type milling machines. Developed for helical milling of cutters, drills, reamers, and similar work, it provides big savings in production costs over knee-type Universals designed for small-lot operations.

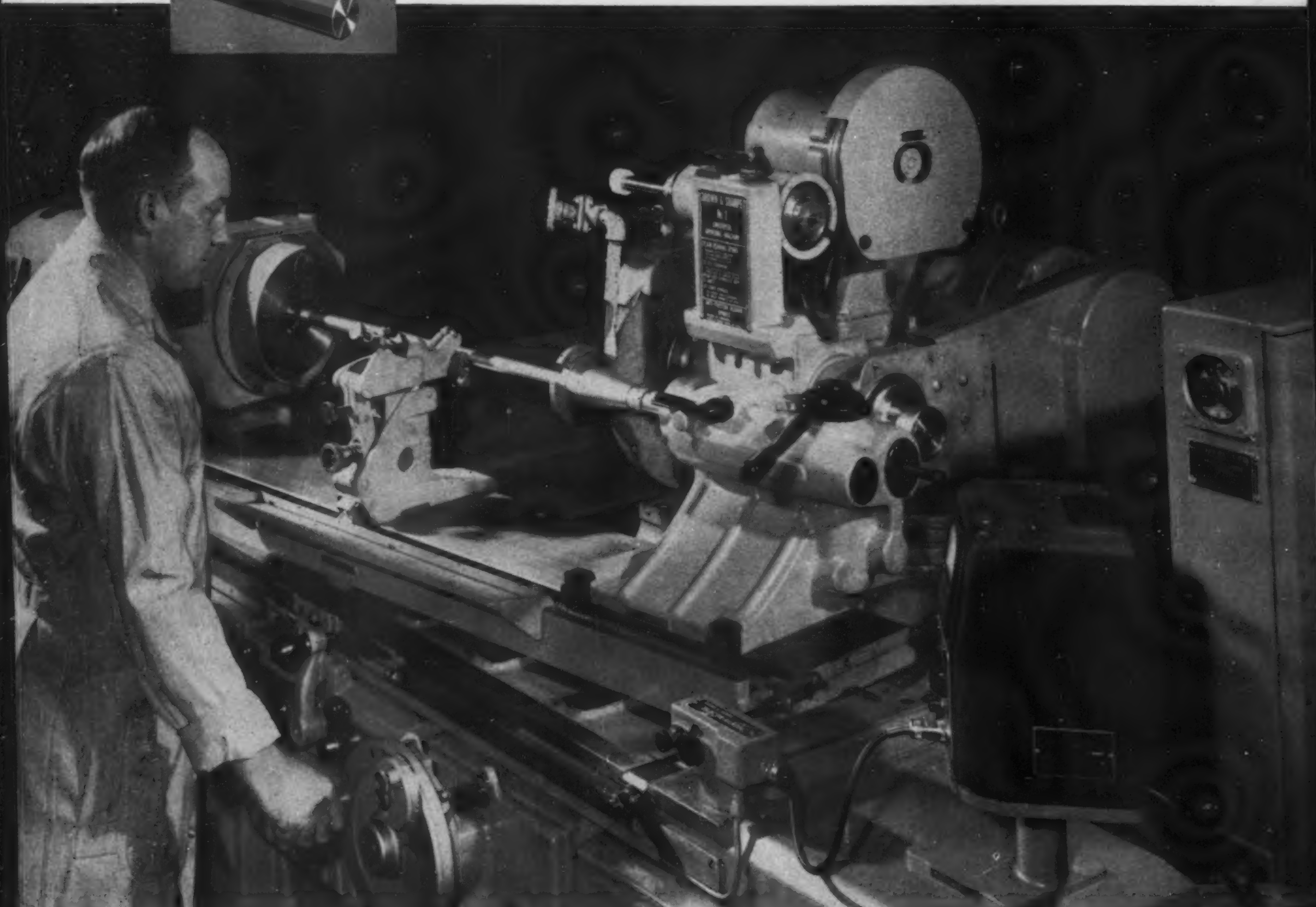
Control operations are automatic, freeing operator for other duties after work piece has been loaded and machine started. Automatic operations include separation of cutter and work to provide necessary clearance required for the run back in helical milling.

Cutting feeds more than double those practical on knee-type machines have been used for work transferred to the No. 12A, and surface quality improved. The rugged bed-type construction and full bearing support of the table ways, and the rigid arbor support provide ideal conditions for the heaviest cutting loads.

For complete information on all the cost-saving advantages of the No. 12A Universal, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

TO HELP YOU GRIND MORE FOR LESS



BROWN & SHARPE design for dependable grinding economy includes . . . Completely Universal Wheel Spindle Head on Turret — Set Diamond Wheel-truing Attachment for Internal Grinding — Power and Hand Cross Feed in Both Directions — Power Cross Feed Continuous to Finish Diameter Setting — Positive Stop for both Internal and External Grinding — ELECTRALIGN for Instant Table Alignment.

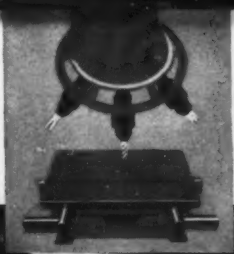
Universals that deliver more grinding minutes per man-hour - save up to 75% in floor-to-floor time

Brown & Sharpe Universal Grinding Machines provide many exclusive advantages that simplify the operator's task, save set-up time, and speed up non-grinding motions. Job time saved often totals 75% or more.

Only Brown & Sharpe offers the ELECTRALIGN®, the original electronic indicator for swivel table alignment — the only device that permits instant alignment to 10 millionths per inch of workpiece with a single setting. The operator is fully relieved of the need for calculations. No delay for repeated gaging and adjustment, and no scrap.

For top returns in cost-reduction, you need all the extra advantages of Brown & Sharpe design when you choose grinding machines for toolroom, prototype operations, or for production grinding. Why settle for less? Four machine sizes. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER



TURRET DRILLING MACHINES...
TO HELP YOU DRILL MORE FOR LESS

AT MINNEAPOLIS-HONEYWELL, BROWN INSTRUMENTS DIVISION, Philadelphia, six Model A B&S Turret Drilling Machines are used for a wide variety of drilling, tapping, boring, and reaming operations — permit 2 to 5 times faster production than with box-jig gang drill methods. In the typical part (below), the casting is cut away to show the 10-micro finish of the holes reamed at the top.

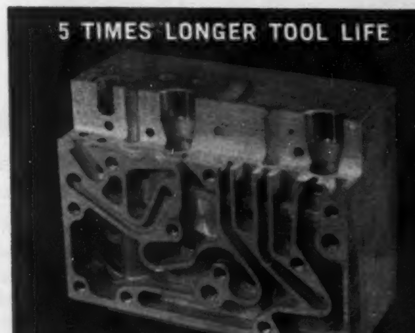
Reaming to 10-micro finish with carbide tooling on Brown & Sharpe Turret Drilling Machines

Machining complex die castings of No. 13 aluminum for a Minneapolis-Honeywell industrial process instrument was a "tool-killer" when the conventional method of box jigs on gang drill presses was used. For combination reaming of 2-diameter holes cored in the casting, a carbide reamer was tried, but the percentage of rejects remained high, and a tool-life of only 100 pieces made tool costs prohibitive.

The job was transferred to a Model A B&S Turret Drilling Machine equipped with a B&S Positioning Table and a simple work-holding device in place of the box jig. Using the same carbide reamer without guide bushings, rejects were virtually eliminated, a 10-micro finish was consistently maintained, and tool-life increased to over 500 pieces.

The B&S Turret Drilling method assures all conditions essential to successful use of carbide tooling — accurate work positioning, rigidity, proper spindle speed, easy chip removal, and ample coolant supply.

Find out how you can use Brown & Sharpe Turret Drilling to save handling time, set-up time, jig costs, capital investment, floor space and maintenance. Write for complete information. Brown & Sharpe Mfg. Co., Turret Drilling Machine Division, 20 Fitch St., East Norwalk, Conn.



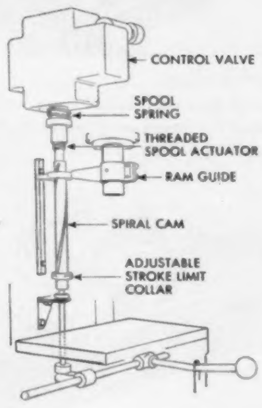
Brown & Sharpe PRECISION CENTER

SERVO CONTROLLED C-PRESS
LOW-COST GENERAL PURPOSE UNIT

The control possibilities of the H-P-M "demand-response" servo press offer many ways to simplify procedures and reduce costs. For example, the instant-response manually controlled action means unlimited opportunities for testing and analyzing all types of materials and processes. The press is compact, easily tooled and adaptable to a variety of applications. Initial cost is low; a single hand lever control is simple and foolproof. The sketch at left below illustrates the principle of this compact press.

ABSOLUTE CONTROL of ram motion is assured. Direct relationship between demand and response is accomplished through a unique spiral cam principle that meters oil to the cylinder in direct response to the action of the hand lever. Speed of motion, tonnage, starting, stopping and repeat strokes are simply controlled by the single hand lever. The operator is in complete command of applied force, the rate of travel and the starting and stopping cycles.

The compact, new H-P-M C-Press Servo Feed Back Control fits neatly in the throat of the press—out of the way—no adjustments or linkages in the tooling area.



IDEAL FOR LAB WORK

Metal Ductility, Tensile Strength, Compression and **Drawing Characteristics** are typical test applications. Ample space for tools and fixtures, long adjustable stroke and complete hydraulic action are measurable benefits with this versatile machine.

Assembly Operations including staking, crimping, riveting and force fits may be predetermined in the lab ahead of actual tooling and production set-up. The **Compacting** of loose or granular materials are typical lab jobs to determine compaction characteristics.

Apply the versatile H-P-M C-Press to your most demanding requirements and when you're through with it, put it to work on the production line. It will fit any job in the plant with hydraulically controlled, manually operated press efficiency. Sizes 5-ton to 15-ton; other sizes and capacities to your specific requirements.

THE HYDRAULIC PRESS MANUFACTURING COMPANY
A Division of Koehring Company • Mount Gilead, Ohio, U.S.A.

H16

Inspect your gears the practical, low-cost way

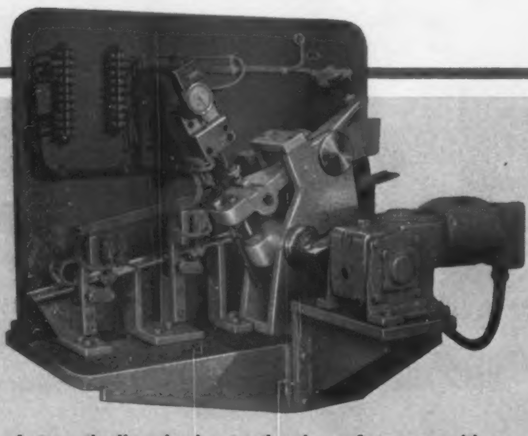
Many gear makers favor Red Ring gear inspection machines because they are precise without being delicate or temperamental — equally effective in either the gear laboratory or the busy production shop. Just practical and economical.

Red Ring machines provide for such Automatic Operations as:

- Gaging of size and helix angle
- Sorting according to size and helix
- Recording of gear measurements

Red Ring machines also check such individual gear characteristics as Index, Eccentricity, Wobble, Lead or Helix, Size and Tooth Parallelism.

We can't show here the many models now in service throughout industry, but you may have Bulletin C-55-9 which describes them in detail. Why not write for it today?



Automatically checks tooth size of gears with integral flanges too large to pass through conventional feed chutes. In-tolerance, oversize and undersize parts are segregated. (Machine cover removed)

Lead Comparator with an additional Interchangeable head for measuring other tooth characteristics. (Tooth spacing head shown)

Rolling fixture provides a rapid check of composite errors and tooth surface roughness.

B287

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Big Hit for Decca --DARINA

Decca Records, Pinckneyville, Illinois uses Shell Darina Grease 2 for the entire plant's grease lubrication.

When Decca Records opened its Pinckneyville plant late in 1957, it required a high-temperature grease for the hot plasticizing mills. After testing many greases under actual plant conditions, Shell Darina Grease 2 was selected. In fact, Darina® proved so successful in its original application that Decca now uses it throughout the plant.

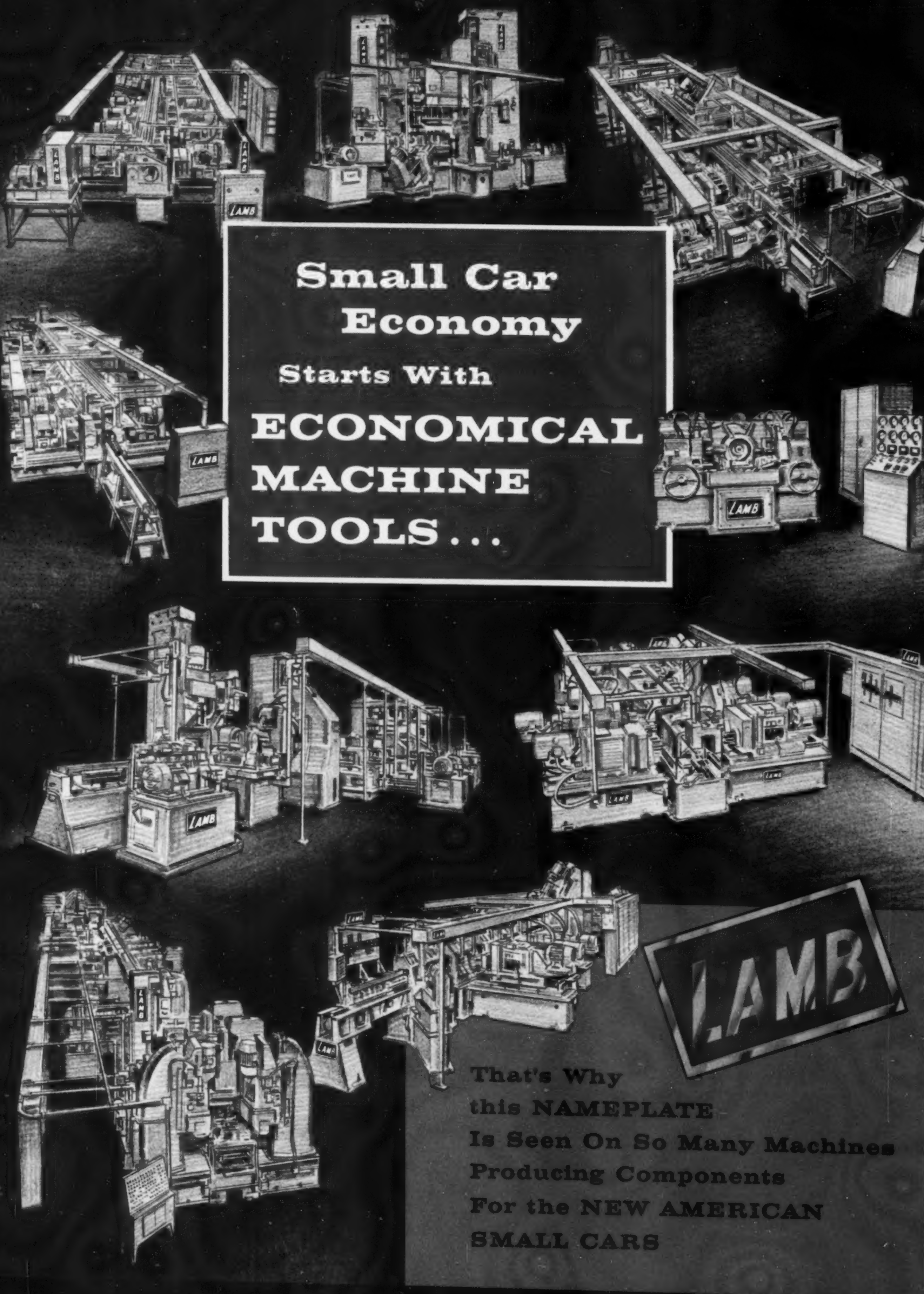
Darina Grease 2 is a premium-quality, multi-purpose grease with exceptional stability in extended high-temperature applications. It offers excellent resistance to corrosion and oxidation. It gives outstanding performance (compared with conventional soap-type greases) for long-time wet or dry applications at temperatures as high as 350° F.

For complete data on Darina Grease, write Shell Oil Company, 50 West 50th Street, New York 20, New York, or 100 Bush Street, San Francisco 6, California. In Canada: Shell Oil Company of Canada, Limited, 505 University Avenue, Toronto 2, Ontario.

SHELL DARINA GREASE

the multi-purpose, high-temperature grease

SHELL

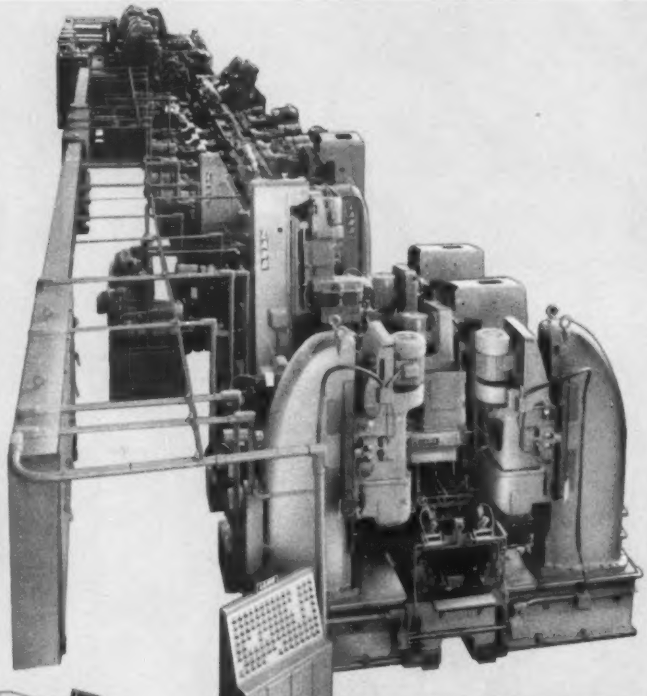

Small Car
Economy
Starts With
ECONOMICAL
MACHINE
TOOLS . . .
LAMB
That's Why
this NAMEPLATE
Is Seen On So Many Machines
Producing Components
For the NEW AMERICAN
SMALL CARS

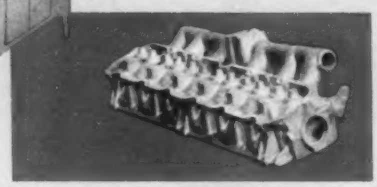
LAMB Original and Retooled Special

Cylinder Head 76-Station Transfer Type

This machine is comprised of two separate sections. The first section (56 stations) is for dry operations. The second section (20 stations) is for wet machining.

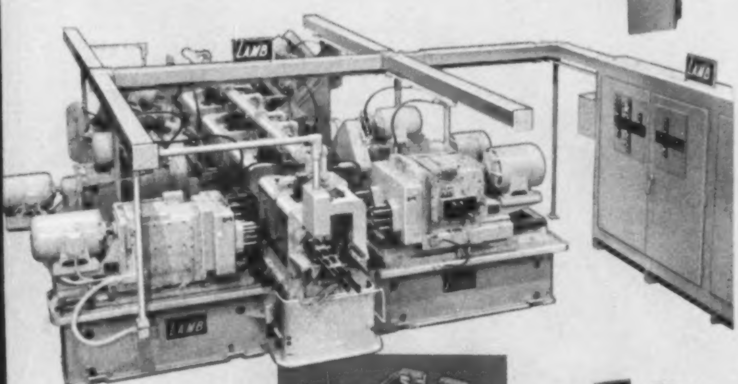
The cylinder heads are machined in seven different positions—5 surfaces finished and 110 holes finished. Production is 113 pcs/hr. at 100% efficiency. Operations include: rough and finish mill, rough and finish bore, drill, tap, ream, counterbore, spotface, chamfer, hollow mill, core drill, wire brush, probe, finish form valve seats and gun ream stem holes.

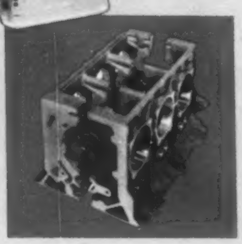


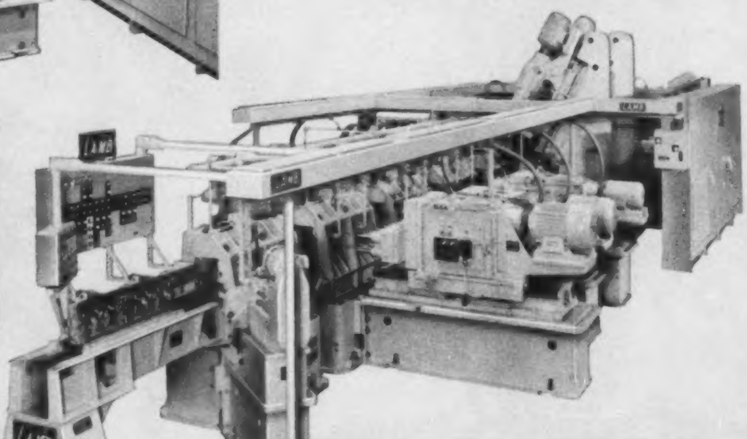


Crankcase Assembly 11-Station Transfer Type

Left and right halves of cast aluminum crankcases are processed through this unit. The production rate is 174 pcs/hr at 100% efficiency. Operations performed are: drill, combination drill and chamfer, ream, tap, straddle mill, slot mill and probe.







Crankcase Assembly 13-Station Transfer Type

Both halves of the cast aluminum crankcases are fed through the machine simultaneously. The production rate is 150 pcs/hr at 100% efficiency. Operations performed are: combination drill and chamfer, combination core drill and rough counterbore, core drill, bore, ream, finish counterbore, tap and probe.

LAMB *Means Lower Initial Cost*

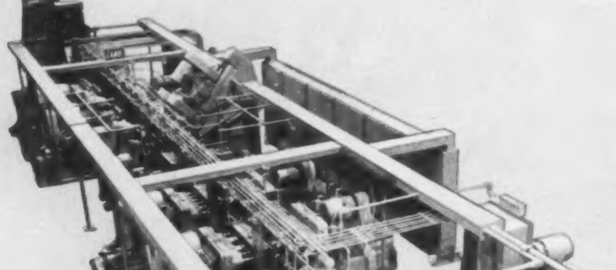
LAMB *Means Shorter Lead Time*

and Transfer Type Machines No
New SMALL CAR Manufactu

The economy found in the purchase price and operating cost of the new American small cars is a direct result of economical production machining of components. Metalworking equipment that shapes the engine block, head, pistons, transmission, etc., must be low in cost and high in efficiency before any savings can be passed on to the auto buyer.

Lamb machine tools meet these critical cost and efficiency requirements. Lamb's ability to build new machines and rebuild existing equipment to meet high production and quality standa result of broad experience in modern manu methods and a thorough understandin tomers' problems.

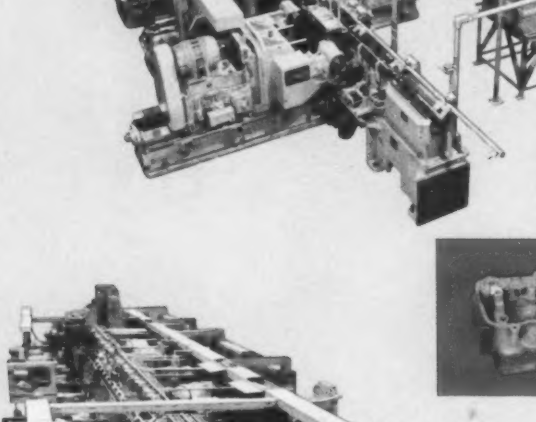
Typical examples of Lamb machines and they produce for American small cars are these pages. The variety of part piece operations performed by each machine illustrate Lamb's creative engineering in *the machine that does the job most efficient*



Cylinder Head 75-Stat
3-Section Transfer Ty

This machine has three (3) separate s 18-station sections and a 39-station s aluminum and cast iron cylinder heads th broached only, are processed through t The production rate for cast iron heads at 100% efficiency and 200 pcs/hr at 100 for cast aluminum heads.

Operations performed are: mill, drill, ch counterbore, spotface, coredrill, tap and throats are rough and finish formed. In haust bosses are rough and finish hollow seats and stems are finish formed and Valve guide bushings are pressed in aluminum heads.



LAMB *Means Reduced Obsolescence*

LAMB *Means Lower Cost Per P*

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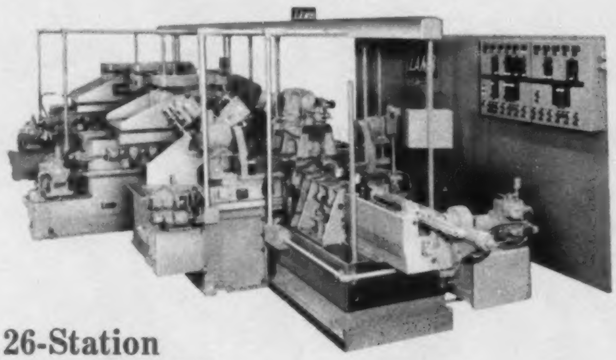

Station
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l, chamfer, ream,
and probe. Valve
d. Intake and ex-
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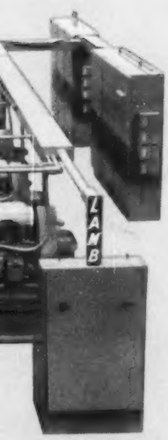
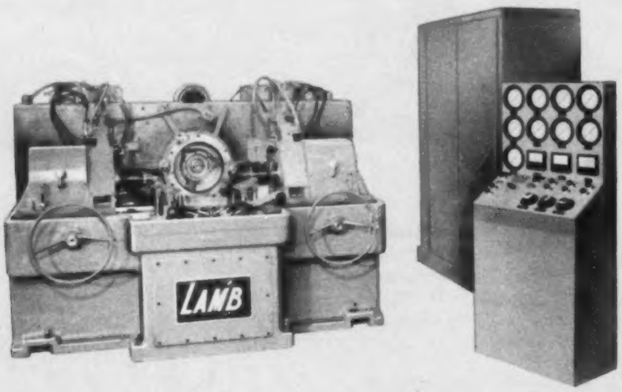
and gun reamed.
d into the cast

26-Station Piston Machine—Transfer Type

An eleven (11) second machine cycle produces 654 pcs/hr at 100% efficiency. Operations include: locate and clamp, bore off-center wrist pin bores, drill and probe angular oil holes in wrist pin bores, finish mill balance bosses, reposition pistons, drill and probe holes in piston dome, mill smoke slots.





Transmission Final Test Machine

This unit simulates the most severe conditions under which automatic transmissions will be used and checks all ranges and reverse, with and without loads. Two input shafts simulate rear axles of car. Either axle can be locked out which duplicates one wheel spin on ice or one wheel overload.

Control console permits selection of speed range and dials indicate differential between input and output speed, vacuum pressure and oil pressure.

LAMB CREATIVE ENGINEERING

Makes production convenience and overall efficiency an integral part of machine design.

Building Block Construction

Standard components are used where possible to provide savings in machine design time, original cost and subsequent rebuilding for model changes.

Convenient Machine Layout

Easy accessibility to all machine components contributes to improved maintenance and service, better housekeeping and working conditions—indirect benefits, but important factors in production efficiency.

Maximum Machine Utilization

The machining capabilities of all working units are utilized to full advantage. This Lamb design approach results in a compact machine that occupies a minimum of floor space, reduces workpiece handling and cycle time.

Flexibility of Use

Lamb machine design provides maximum flexibility of equipment application for present and future production. A few of these features are: "open" arrangement of compact components to permit in-process inspection or added operations, plate type work head construction for simple hole pattern changes, grouped pipe connections for unitized machine rearrangements, interchangeable mounting faces.

Rigidity

Wing and main bases are heavy and sturdy to provide maximum support for the working units. Massive guide bars and ample supports permit maximum machining thrust, faster feeds and speeds. The result is optimum surface finish regardless of the type of operation being performed.

Built-in Production Aids

Fresh ideas that add convenience, safety, simplicity to the operation of a machine are characteristics of Lamb machines. From part loading to unloading every possible production aid is incorporated to assure top quantity and quality of work.

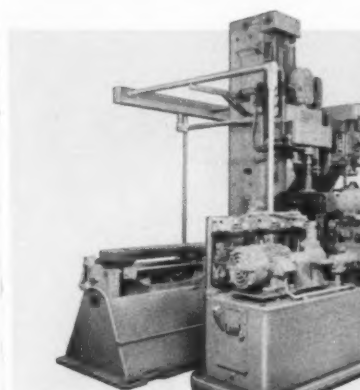
LITHO IN U.S.A.

MORE LAMB

IN SI

Dial Index Ma
6-Station

Transmission front oil pump
chined at the rate of 194 p
efficiency. Operations are:
ream, tap, and trepan.



A complete
finest in spe

F. JOS. LA

Engineers and B

For more data, circle this page number on inquiry card

The Day Maximation Began

In seeking ways to increase efficiency, production men in the metalworking industry have found elimination of hidden machine tool costs through the use of proper filtration equipment a virtual guarantee of maximum output and economy. This method of obtaining increased production rates is known as *maximation*. Although today, it is one of the most significant factors in determining metalworking profit ratios, the maximation theory and its initial applications were actually developed more than 20 years ago.

HOW MAXIMATION STARTED

A number of months after inspection and delivery of several thousand piston rings to an airplane engine plant, the manufacturer was told that the rings were unsatisfactory and would be returned. Metal particles in the coolant apparently had adhered to the rings during the lapping process and the original high polish finish on the inside of the rings was pitted and chipped on removal from storage. About this time, engineers from the U. S. Hoffman Machinery Corp. were pioneering in research and development of dry cleaning principles for the removal of metal from kerosene coolants. Asked to provide a solution to the problem, they designed a pressure filter system for the clarification of coolants.

THEN AND NOW

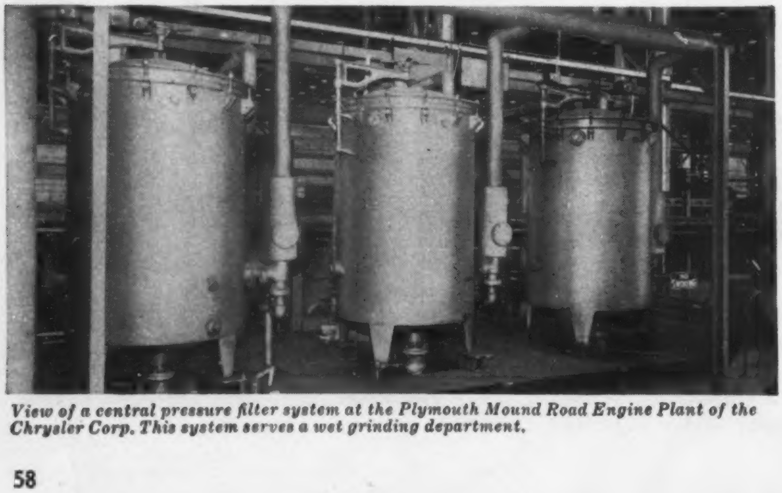
This first filtration equipment by Hoffman was a fantastic complex of pipes and valves. But it did a fine job of bringing clean coolant to the work. A few months later, Fafnir Bearing asked for 2 pressure filters "just like the original." From these pioneering concepts have come Hoffman's modern equipment. Today, Fafnir Bearing employs more than a dozen advanced Hoffman individual and central filtration systems.

At Fafnir and in thousands of other plants employing filtration, coolants and lubricants once contaminated by metallic chips, abrasives and other extraneous dirt are no longer responsible for high production, maintenance and costs, as well as premature obsolesence. Through proper filtration, machines originally designed and tested for peak efficiency with clean lubricating oil and clean coolants can now operate at or near rated capacity. Filtration has made it possible to obtain a 30 to 50% savings in grinding wheels, honing stones, broaches, cutting and other edge tools in addition to providing numerous collateral benefits and advantages.

TYPES OF FILTRATION EQUIPMENT

In making recommendations for solving filtration problems, Hoffman engineers draw on a complete line of equipment which includes;

PRESSURE FILTERS—This type of filter gives up to 100% clarity and is widely used with grinding, cutting and honing oils as well as water soluble oil coolants where finest clarity is consistently required. Easily adapted for large groups of machines. Unlimited coolant capacity.



View of a central pressure filter system at the Plymouth Mound Road Engine Plant of the Chrysler Corp. This system serves a wet grinding department.

FLOTATION EQUIPMENT—Automatic flotation units increase the productivity of machine tools and eliminate down time for sump cleaning. Provide excellent results in steel and cast iron applications with efficiencies of over 98% in one pass. Handles flow rates from 40 to 1500 gpm.

MAGNAFLOW SEPARATORS—Fully automatic and self-cleaning, Hoffman Magnaflo Separators remove from 75% to 90% ferrous solids from cutting oils and water soluble coolants. Flow rate from 40 to 1,000 gpm.

VACU-MATIC FILTERS — For continuous filtering of coolants from *individual* machine tools. Provides unusually high flow rates in continuous filtration of water soluble coolants. Completely automatic and self cleaning. Flow rates range from 40 to 2,500 gpm.

DISC FILTERS — Filter oils containing finely divided particles. Geared for continuous flow.

SUCTION FILTERS—Provide fine filtration on small flow rates for lapping, microhoning, grinding and similar operations. Cap.5-60 gpm.

SUMMING UP

Proper filtration delivering clean coolant makes it possible to achieve maximation with these savings.

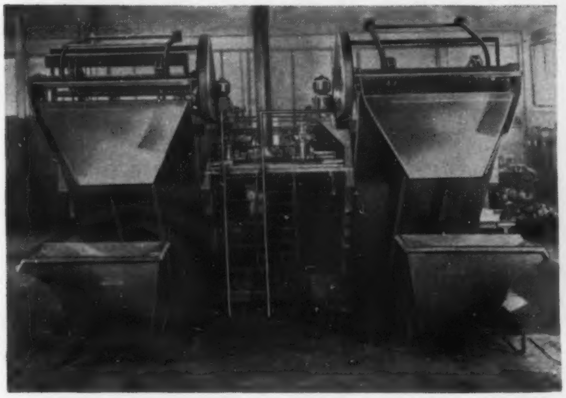
- Greatly reduced down time
- Higher speeds
- Improved finishes—fewer rejects
- Longer useful life of coolants
- Life of edge tools extended
- More sustained tolerances
- Fewer stoppages, adjustments
- Scrap loss considerably reduced
- Elimination of motor pumps
- Curtails bacteria and rancidity
- Saves 25 to 50% in grinding wheels, honing stones, broaches, individual machine tools.

To check on the unlimited industrial applications of individual tool and complete central filtration systems, send for free bulletins and case histories on equipment described above.

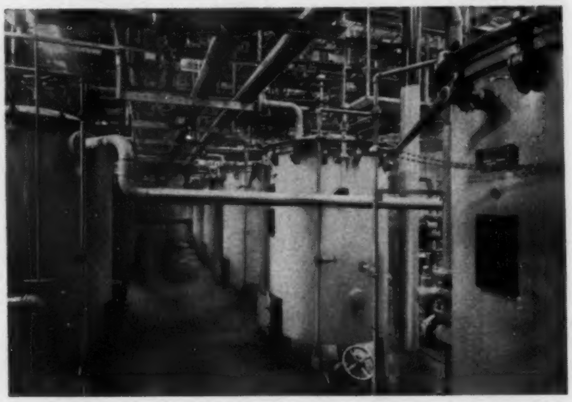
Please write:
U.S. Hoffman Machinery Corp.
Dept. LR, Industrial Filtration Div.
Thompson Road—Plant #1
Syracuse, New York

Today's high production costs dictate a good hard look at metalworking tools and techniques—make a reduction in operating expenditures essential to increased profit margins. Here are typical examples of companies which have obtained maximum production from machine tools by eliminating unnecessary and often hidden expenses through the use of Hoffman filtration equipment.

They're Beating High Machine Tool Costs and Obsolesence



A Hoffman Central Flotation System serving 28 grinding machines at an International Harvester plant. The coolant serving the sickle grinding department is a water-base soluble oil.



A Hoffman Central Filtration System consisting of 9 Hoffman Pressure Filters, Model I-80S, each equipped with Hoffman Dual Magnaflo Plates—with a flow rate of 150 gpm and sludge collector conveyor—(Magnetic separator), are shown at the plant of a leading automotive and aircraft accessory manufacturer.

This system enabled International Harvester to make the following savings:

Cleaning of coolant trenches completely eliminated —savings of $10,000 annually.

Trucking costs for the removal of sludge to a disposal point reduced 65.5%. Saves $8,122.50 annually.

Cost of grinding wheels reduced 47.4% — saves $65,477.19 annually.

Production per grinding wheel increased 134%.

Cost for wheel-change-over reduced 57.3%.

Adding these and others, the total savings for this particular year were significant.

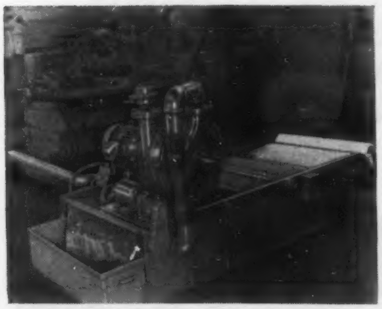
The following tabulation is a percentage breakdown of actual savings made with this Hoffman Central Filtration System equipped with a Magnetic Separator and sludge collector conveyor for automatic removal of sludge collected by filters, magnetic plates and gravity settling.

Grinding Oil 2.5%

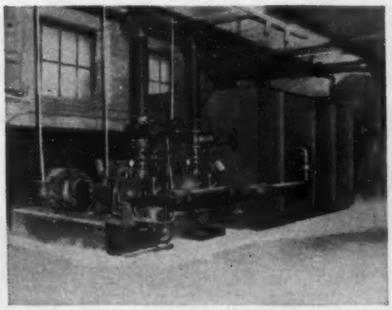
Diamonds—Grinding Wheels 43.4%

Production scrap (resulting from improved quality of product) 32.5%

Labor to operate system and actual production labor @ $2.00 per hour 21.6%



A Hoffman Vac-80 Vacu-Matic Filter is shown installed on a Norton 30" diameter stepped-wheel grinder for grinding transmission shafts at the Syracuse plant of a large automotive manufacturer. Most Norton grinders are equipped with Hoffman Vacu-Matic filters when shipped.



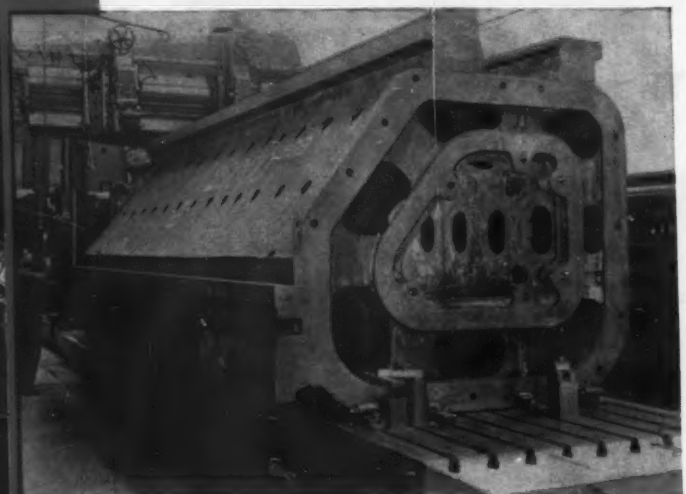
At the Union Twist Drill Co. in Athol, Massachusetts, a Hoffman Magnaflo Separator removes metal particles from oils and coolants to solve numerous clarification problems. Result—many money-saving improvements in manufacturing technology and product quality.

A money-saving Hoffman Flotation Unit at the Fafnir Bearing Company. It is designed for plant wide distribution of water-base coolant. The company credits Hoffman systems for great improvement in critical finish grinding operations on bearing races.

For more data, circle this page number on inquiry card

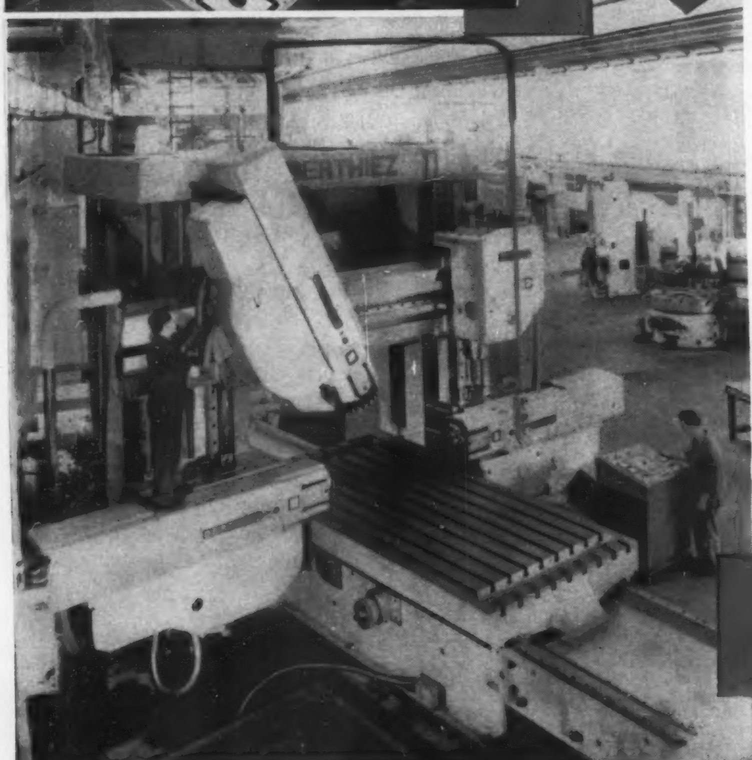
BERTHIEZ

Double Upright Planing
and Milling Machine type R F 2-200

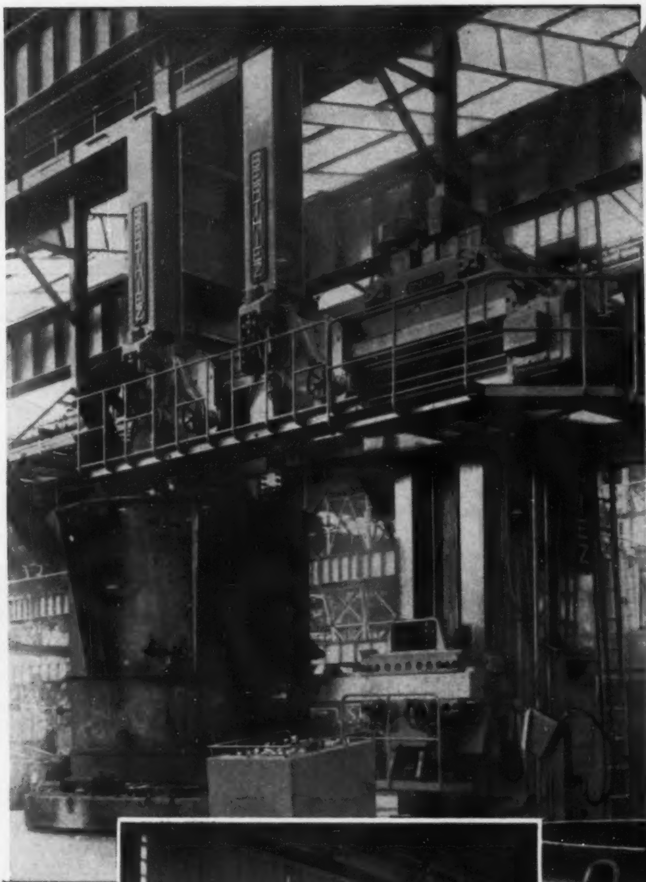


Single Upright Planing Machine
type 9120

Double Upright Plano Milling Machine
type F 2 - 200

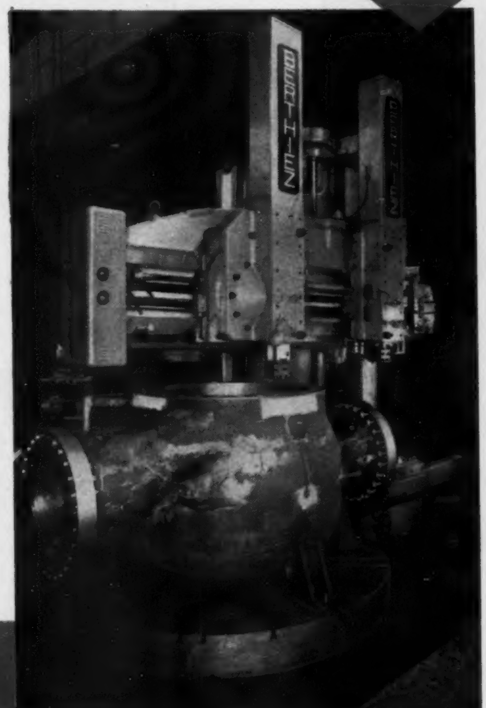


All BERTHIEZ
Planing Machines
plane both ways i. e.
cut coming and going



Vertical Boring and Turning Mill type 9375

Vertical Boring and Turning Mill type 9135



Vertical Boring and Turning Mill type BML180

Vertical Boring and Turning Mill type BM 225

BERTHIEZ

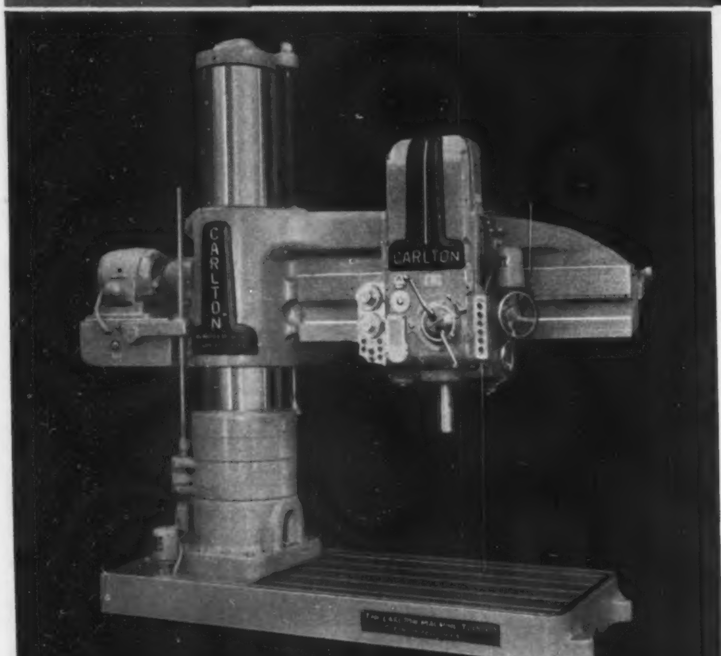
11, RUE MONTALIVET - PARIS 8e - TÉL. ANJ 47-60

Model	Column diameters	Arm lengths	Speeds No.	Speeds Range	Feeds No.	Feeds Range	Motor recommended
0A	9"	3'-4'	9	20 to 1	4	.006-.020	3-hp
1A	9" 11"	3'-4' 3'-4'-5'	12	25 to 1	6	.006-.025	5-hp 5 or 7½-hp
3A	13" 15" 17"	4'-5' 4'-5'-6' 5'-6'-7'	36	100 to 1	18	.004-.125*	7½, 10, 15, 20 or 25-hp
4A	19"	6'-7'-8'	36	100 to 1	18	.004-.125*	15 to 40-hp
5A	22" 26"	7' to 10' 8' to 12'	36	100 to 1	18	.004-.125*	20 to 40-hp†

*8, 11½, 14 and 18 threads per inch are standard, with various other combinations available.
†Driving motor larger than 40 hp can be used if desired.

Carlton . . . the modern design radial drill

0A 1A 3A 4A 5A



Only at Carlton can you take your choice of

- 5 different models of radial drills
- Column diameters from 9" to 26"; arm lengths from 3-ft. to 12-ft.
- 5 different types of speed-feed controls (3A, 4A and 5A models)

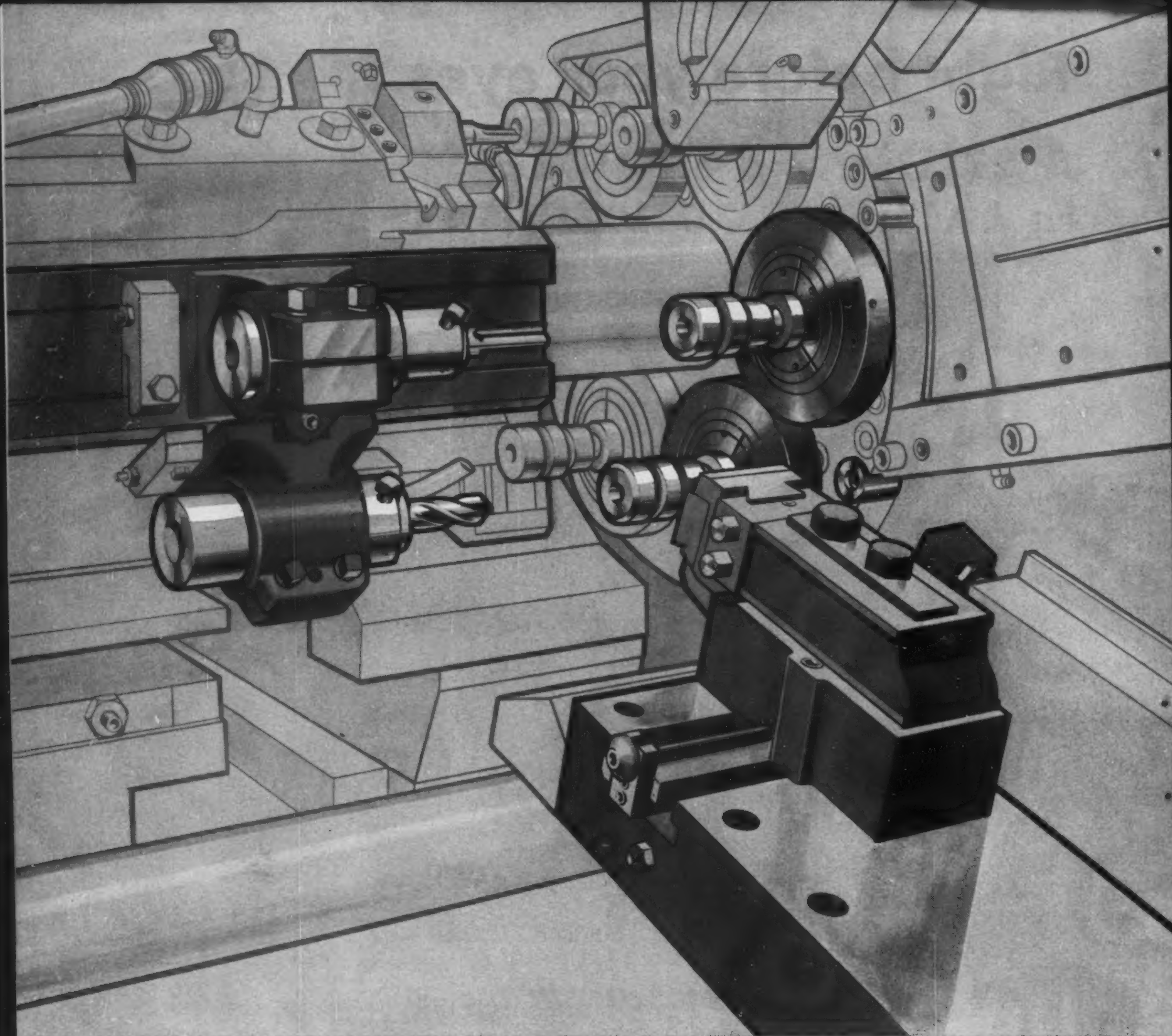
For the utmost in versatility, you can choose the Carlton Programming System that lets you pre-set speeds and feeds for a complete drilling sequence of 20 or more operations.

For production operations involving fewer and less complex drilling sequences you can select from among three speed-feed controls that help make the machine more productive: Pre-select, Power range Pre-select and Partial Pre-select.

And in manual control, Carlton's simplified pushbutton control head is the most modern in design and easiest to operate.

There's no compromising at Carlton . . . where you select the radial drill that fits your requirements exactly. Write today for bulletins describing the sizes you need. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton *Specialists in radial drills*



New Britain's **answer** *to a serious threat*

Overseas production of just about anything you care to name is making serious inroads on American domestic and foreign markets. It's no secret that European and Asian industry is catching up fast technologically—and they have a real competitive advantage in plenty of low cost skilled labor. While many foreign products are still inferior to those of domestic manufacture, this is far from true in all cases. The answer is, of course, increased productivity at lower cost.

In its all-new line of bar machines, New Britain has developed the most modern bar-turning units available. Five models in two different series are offered with capacities from $1\frac{1}{4}$" to $5\frac{5}{8}$". These machines are designed for really fast, trouble-free, high-precision production. More operations per machine are possible than ever before. Wide open tool areas allow unlimited combinations of end working and forming tools. New Britains will stay new longer. The exclusive wear-preventing features so familiar to New Britain users have been retained and improved. Catalogs on both the small and large series machines are yours for the asking. After looking this literature over if you think one or more New Britains may help improve your competitive situation, we will be happy to review your prints and arrange a demonstration. No obligation, of course. Call us or call your local representative. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

precision boring–*New Britain's new approach*

New Britain Cam Actuated Vertical Precision Boring Machines offer an entirely new principle for more accurate boring and turning, plus compact exterior design and fast tooling. Rough cuts and finish cuts within close tolerances on the same set-up are characteristic. Standard models are available with maximum swing from 12″ to 17¾″ in 10 or 15 horsepower.

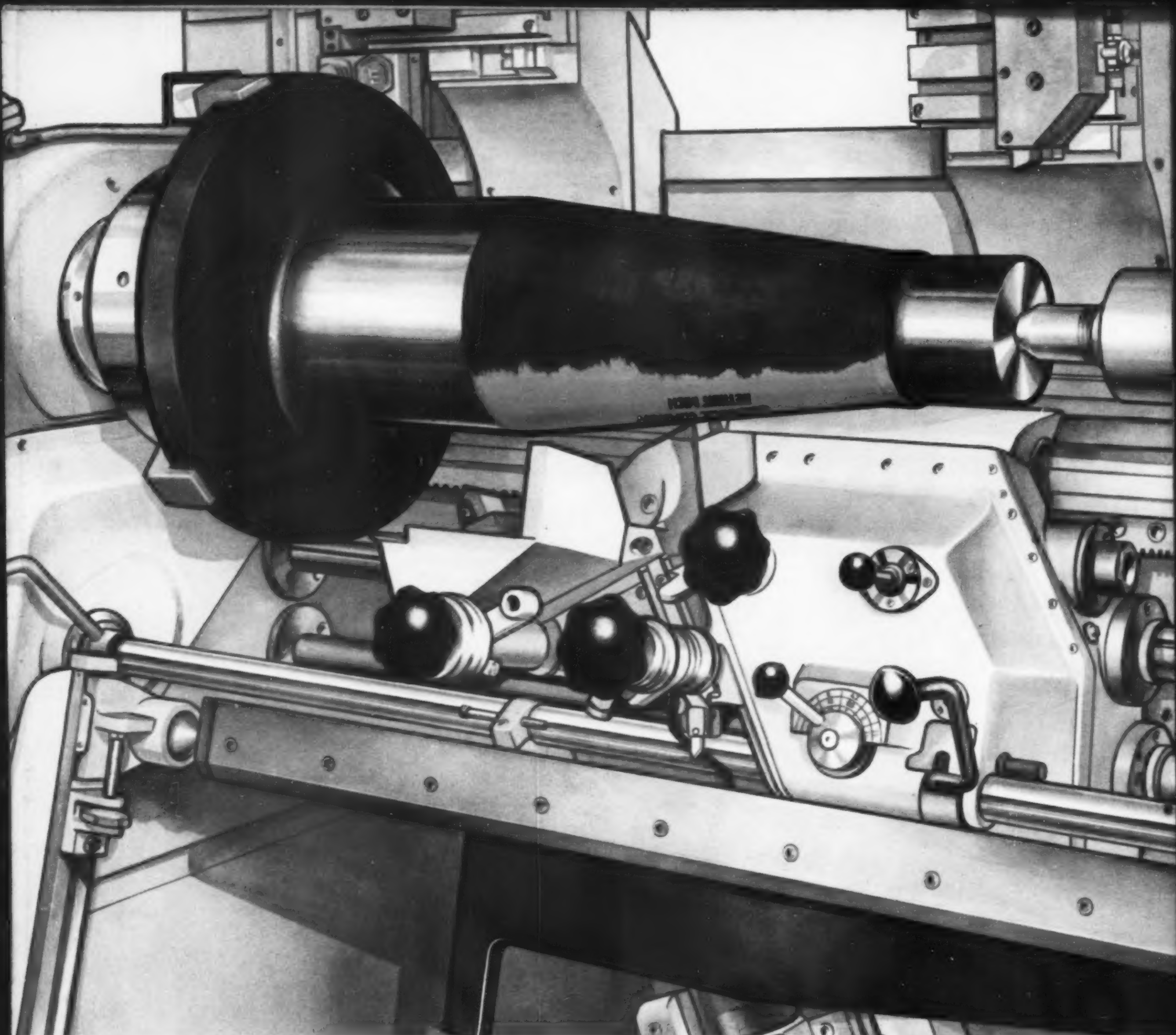
Here are a few of the major new developments incorporated in these unusual machines.

Greater accuracy. Both the vertical and cross slide cams are mounted on a common shaft which is contained inside the vertical slide. The linkages found in conventional cam-operated contouring machines are eliminated. Both the vertical and cross slides ride on preloaded roller bearings and are deflection-free.

Clean-sided design. Any number of these self-contained machines, each with one or more spindles, can be arranged side by side. Depending on how they are tooled, they operate either as a single unit or as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine, finishing both sides, completing *all* operations in one integrated, high-volume operation.

Fast tooling. Unrestricted accessibility allows rapid tool and cam changes.

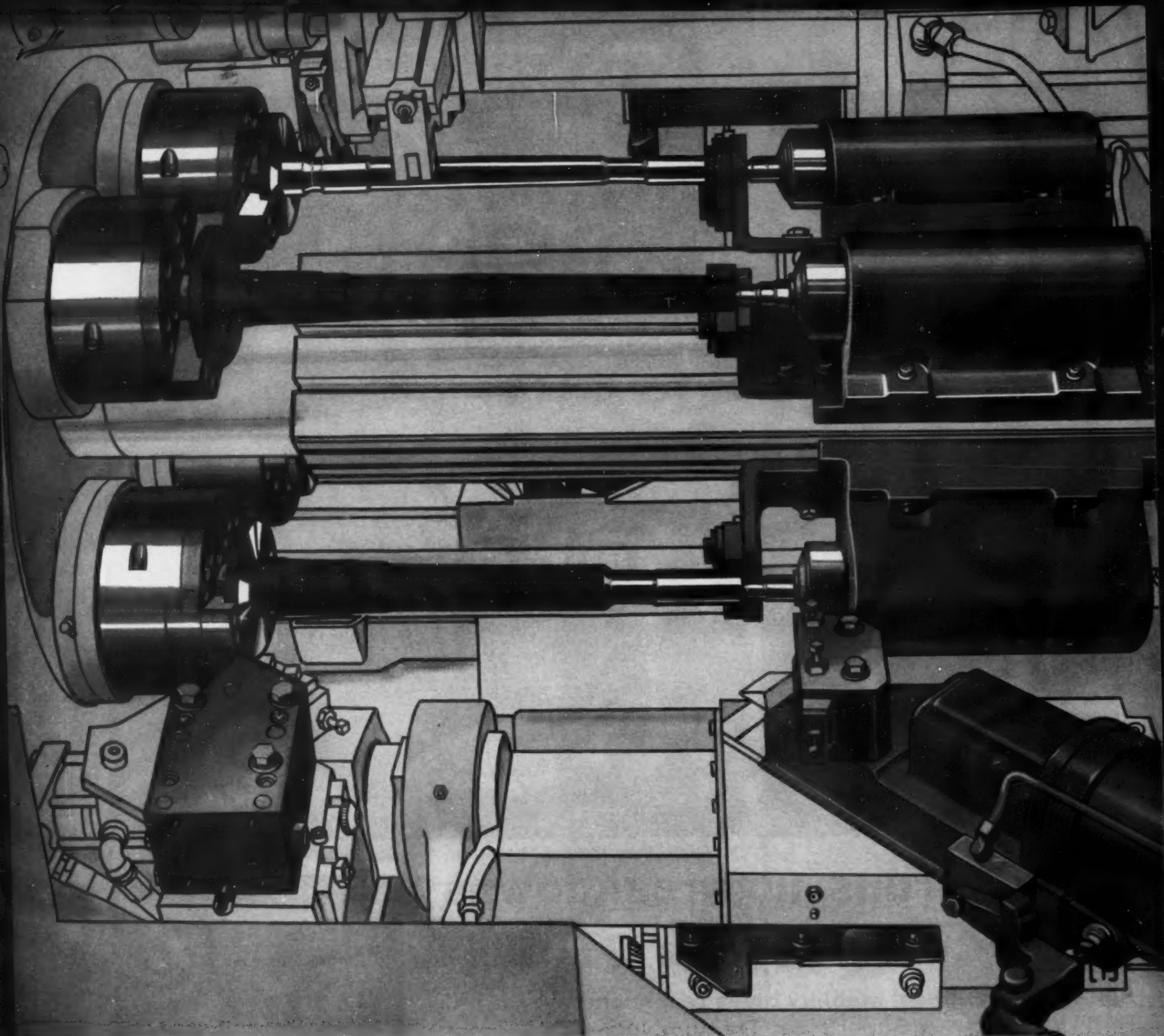
Complete catalog material is available. For your copy, write New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



why a **copying lathe**–*why New Britain* **+GF+**

Beyond a certain point sustained production of the same piece on an engine lathe becomes uneconomical. Sometimes, however, the feeling exists that a copying lathe lacks flexibility, power and ruggedness or that it is just too "special." A New Britain **+GF+** has power—25 to 40 h.p. The **+GF+** has rugged design to handle big work and it's really flexible—a prototype or flat template will reproduce one or more pieces with fast, single point tooling. Whether it's shaft work or chucking work you have to do, ease of set-up is the same. The template or prototype can be changed in minutes. No special tooling set-ups are required, either. You can quickly switch from intricate cuts on slender shafts to heavy cuts on big castings or forgings (like the one shown). Complex profiling presents no problems even on jobs requiring really heavy metal removal.

Fast set-up and changeover from one type of work to another is only part of the story. There's much more that you'll want to know about the New Britain **+GF+**. Watching one of these machines in action is the best way to get the whole story and we'd like to arrange a demonstration for you. If you'd like to look over catalog material, we have that too, of course. Write New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



idea *for volume producers of shafts*

Economists are making startling predictions on this year's increase in productivity. They say it will be twice that of recent years — up as high as 10% in some manufacturing industries.

Whether or not these predictions come to pass, it's certain that it won't happen in plants using outdated equipment.

Shaft work is a problem to many firms. New Britain pioneered template-controlled contour turning and boring, solving the problem for many progressive companies. Now for the manufacturer with really high volume requirements we present Model 412/25—a four-spindle, template-controlled machine capable of producing a four-fold increase in productivity per man hour.

The basic principle pretty much speaks for itself. As in the case of the single-spindle contour lathe, inexpensive metal templates control the full cycle and re-cycle if required. Simple, single-point tools replace complex gang tooling. Set-up is simple and fast. When tools wear, merely replace them. Since all relationships are maintained by the template, tool replacement involves no problem.

When the volume of contour turning warrants it, this machine can be the best money maker on the production floor. Your New Britain representative can quickly tell you after looking at your prints and learning of your production requirements. Meanwhile, we would be glad to mail you descriptive literature containing the basic facts and specifications. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

"No reruns, no breakdowns with Cities Service QT Oils"

Exceptional stability gives real economy says Super Heat Treating, Inc.

At Super Heat Treating, where tolerances run as fine as .004, Cities Service QT Oils have proven their ability to remain stable and deliver these tolerances over periods of 18 months and even longer.

"With Cities Service QT 1 and 3, we handle all sizes of work under the most exacting conditions, without breakdowns or reruns," says President Albert G. Lintel, Jr. "Not only does this performance provide notable economies, but it is a big factor in our ability to offer 24 hour service to our clients. I don't know how an oil could do any more than that."

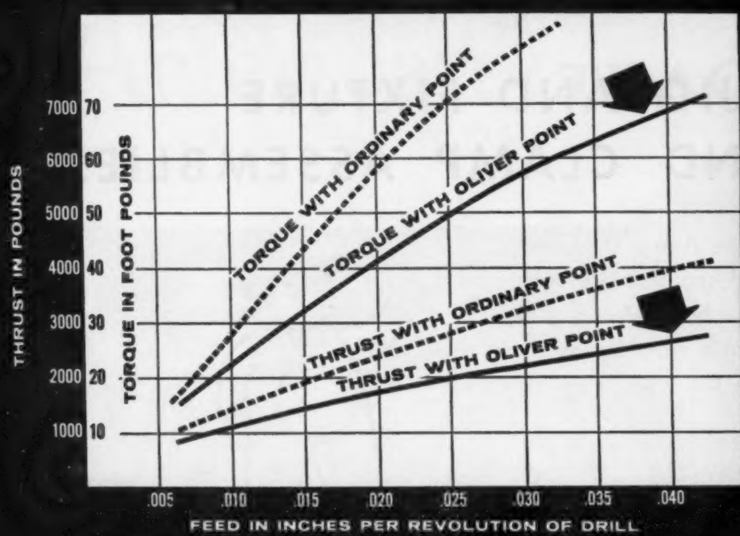
Again and again, where tolerances are fine and production schedules tight, metalworking firms are turning to Cities Service QT Oils. Some advantages: Better wetting ability, improved cooling power, superior oxidation resistance, high flash and fire point. For a glimpse of what these oils might do for you, talk with a Cities Service Lubrication Engineer from the nearest office. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

"We handle anything from hairpin size to 20,000 pounds and deliver in 24 hours," says President Albert Lintel, Jr. "Naturally we need the best quenching oils—and Cities Service makes them."

Hardness characteristics are always excellent at Super Heat Treating. The firm gives much credit to superior wetting ability, cooling power, and oxidation resistance of Cities Service QT Oils.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS



CURVES SHOWING EFFECT OF VARYING FEEDS, TORQUE and THRUST — 1" DRILL IN C. R. S.

OLIVER'S UNIQUE DRILL POINTER

gives you more holes per grind

Substantially less torque—much less thrust!

The above graph is a typical test run by the research department of an eastern engineering school. It is evidence that Oliver can help you get more and better holes per grind.

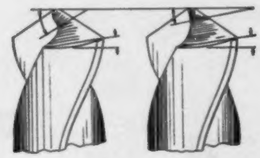
Oliver's sharpening principle is to grind the drill point so that increased clearance is obtained at the center of the drill. Each lip does its equal share and the theoretically perfect point permits easier penetration. Less feeding pressure means savings on drilling machine repairs, power and transmission costs and the drills themselves. *The Oliver point has been successfully used since 1921.*

Oliver drill pointers are rugged enough to stand up to every day pounding. Features of the Model #510 include: a universal chucking head which holds drills from ¼ to 3 inches in diameter and swivels to give varying angles from 82 to 160°; an adjustable cam to give a variable amount of clearance at the cutting edge; and a positive drive to the chuck. In addition, all main shafts—including the grinding wheel spindle—are mounted on anti-friction bearings.

Want proof? Oliver will sharpen *your* drills on a "no-charge" trial basis. Write today for full information. We'd like the opportunity of sending a quotation.

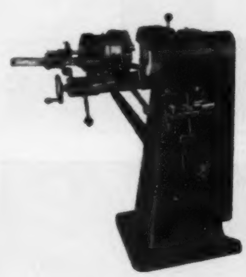
HOW TO REDUCE YOUR TWIST DRILL COSTS

Any substantial reduction in drill costs must be made by choosing a combination of the right drill design *and drill point*. As specialists in the manufacture of tool and cutter grinding machinery we are able to offer drill pointing machines designed expressly for cost reduction.



The sketch above shows a comparison of two drill points. The one on the right is as ordinarily ground. On the left is an exaggerated view of an Oliver drill point. Note that the clearance angle on the point increases very rapidly as the drill web is approached.

It is a widely accepted fact that for a given feed the angle of helix of the feed is greater as it approaches the center. It is this reason that makes increased clearance at the center of the drill point so essential. The Oliver pointers provide average thrust reductions of 25.2% and average torque reductions of 22.0%.



The Oliver 510 makes possible the trouble free grinding of drills—whether 2, 3 or 4 flute. Variable included point angles and clearances are easily obtained.

This cost-saving point is also available by using the new heavy-duty #21 bench model machine. Capacity is 3/32" to ½". A 5" diameter cup wheel and a built-in diamond dresser provides for easy operation regardless of drill size or included angle.

OLIVER of ADRIAN

1410 E. Maumee St. • Adrian, Michigan

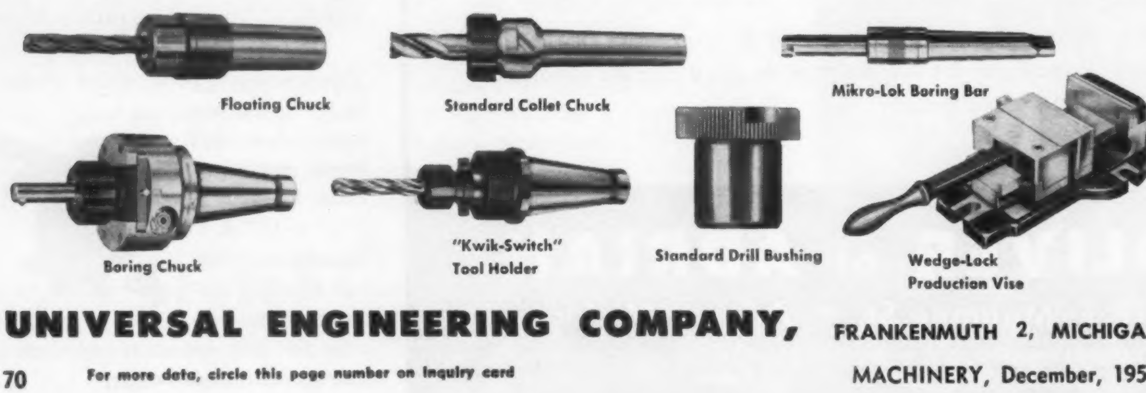
DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

213

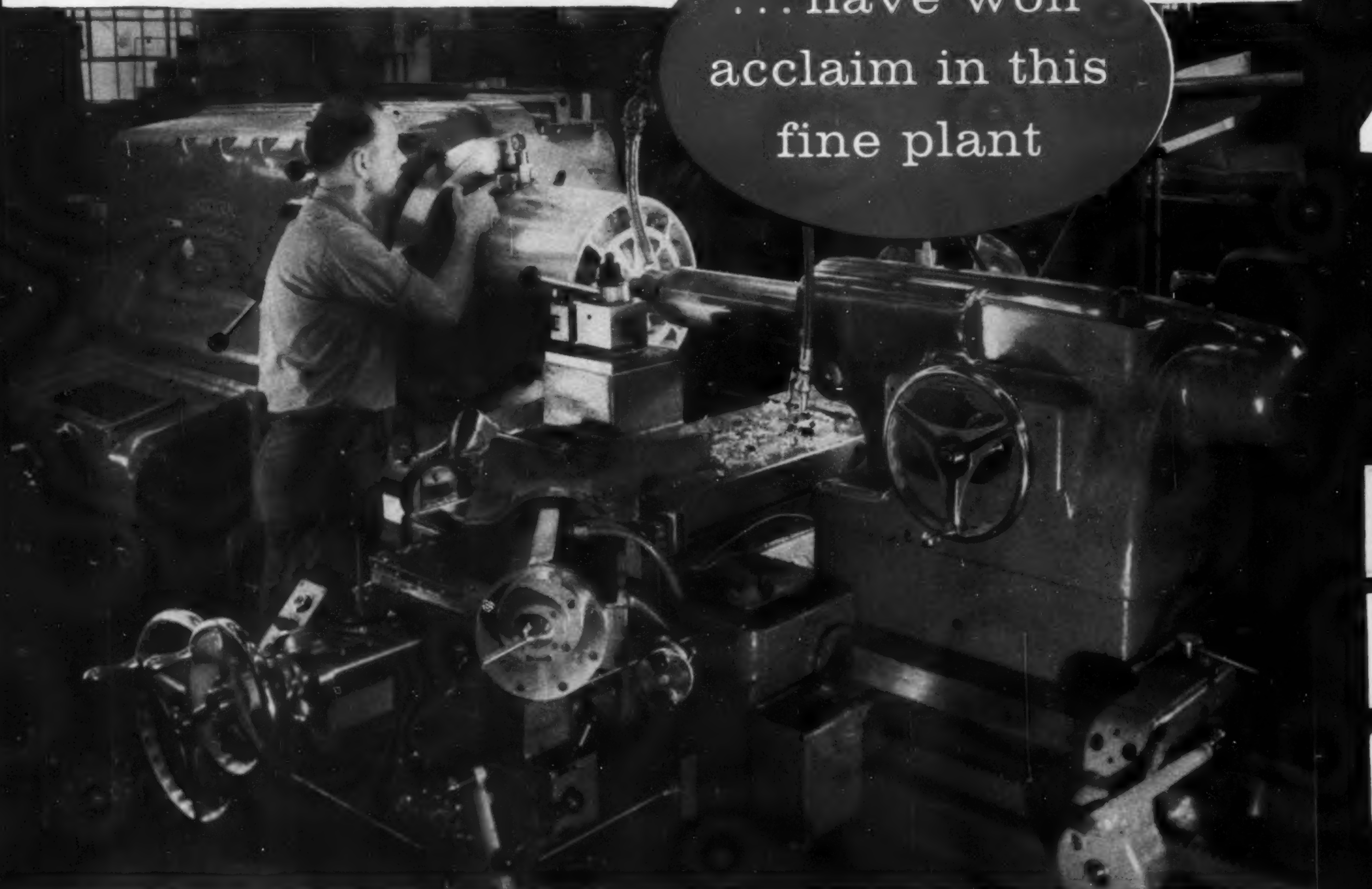
OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS



UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 2, MICHIGAN

"American" TRACER LATHES

...have won acclaim in this fine plant



Bulletin No. 135 gives a complete description and shows many examples. It's yours for the asking.

The Mechanical Division of General Mills, Inc. in Minneapolis, Minnesota uses "AMERICAN" Tracer Lathes for their contouring work. 17 years of ordnance and instrument work have conclusively demonstrated to the General Mills officials that only the highest quality equipment can produce the precision work that their contracts require—result "AMERICAN" selection.

More production per man hour is the answer and only answer to spiraling costs—modern, high production machinery is the answer to greater production per man hour. Judging from reports, the Mechanical Division of General Mills, Inc. has found this to be true.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U.S.A.

LATHES AND RADIAL DRILLS

For more data, circle this page number on inquiry card

Automatic marking of hot steel . . .

Controls by ALLEN-BRADLEY, of course

A-B QUALITY

Here's an interesting job that's gone "push button"—stamping heat numbers on hot steel! Now, from a remote console, the operator automatically sets numbers on the marking head and propels it against the steel. The controls, *of course*, are Allen-Bradley because they provide the continuous reliability that is essential to this production.

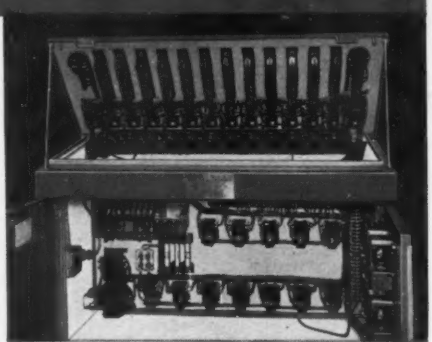
The simple, ONE moving part solenoid design of A-B starters and relays assures millions of trouble free operations. And the double break, silver contacts—used on all A-B control—eliminate costly downtime for maintenance. Keep your production lines rolling . . . insist on Allen-Bradley *quality* motor control. You cannot do better!

Allen-Bradley Co., 1331 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

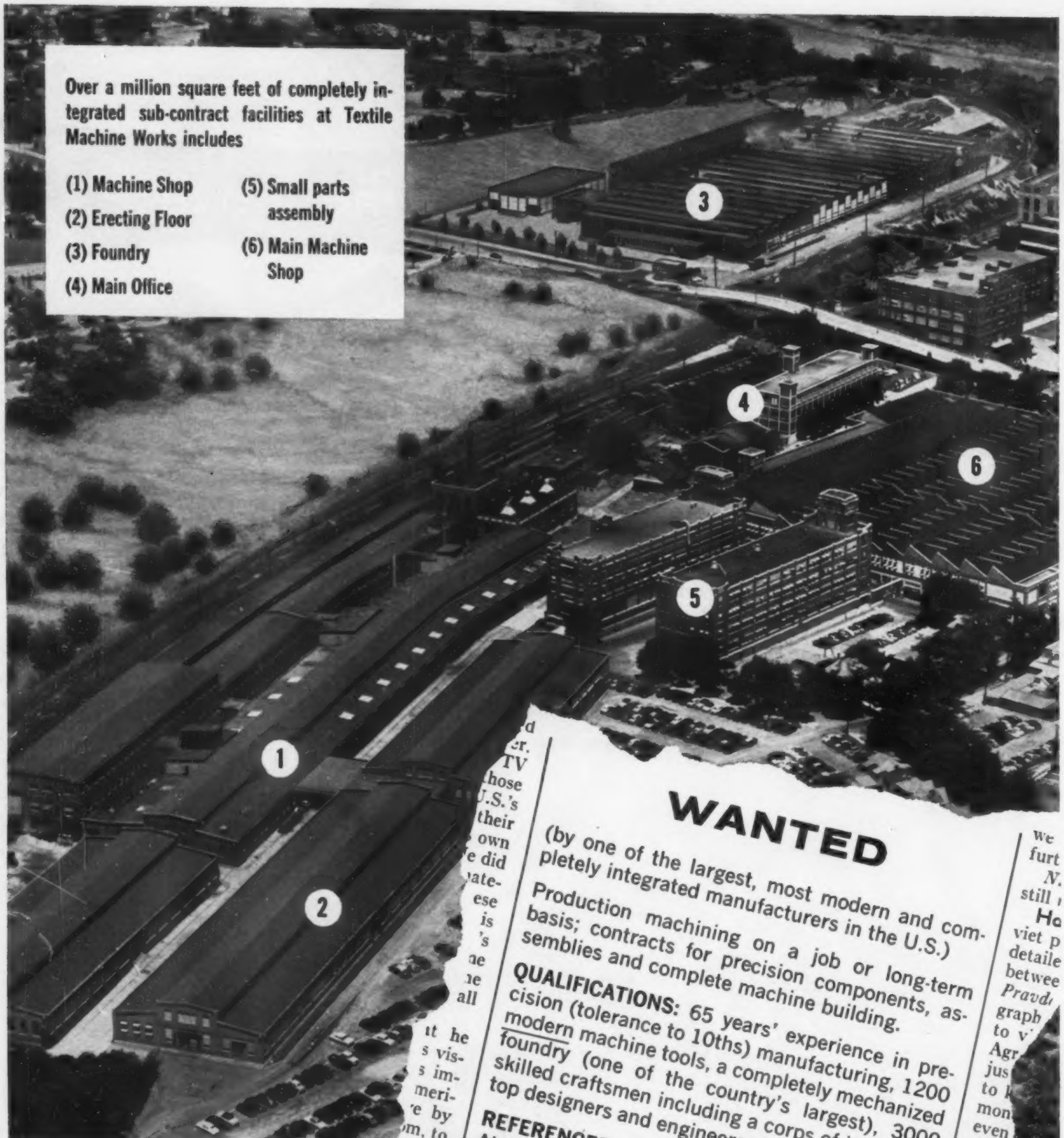
ALLEN - BRADLEY

Member of NEMA

Quality Motor Control



The relays and push buttons used in the remote control console of this M. E. Cunningham Marking Machine are all standard Allen-Bradley catalog items.



Over a million square feet of completely integrated sub-contract facilities at Textile Machine Works includes

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(6) Main Machine Shop

WANTED

(by one of the largest, most modern and completely integrated manufacturers in the U.S.)

Production machining on a job or long-term basis; contracts for precision components, assemblies and complete machine building.

QUALIFICATIONS: 65 years' experience in precision (tolerance to 10ths) manufacturing, 1200 modern machine tools, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen including a corps of industry's top designers and engineers.

REFERENCES: The best . . . companies like Alcoa, Du Pont, Chrysler, Eastman Kodak, Western Electric, Fairchild Aircraft, Ingersoll-Rand and others who know they can depend on TMW for quality, accuracy and on-time delivery at minimum costs.

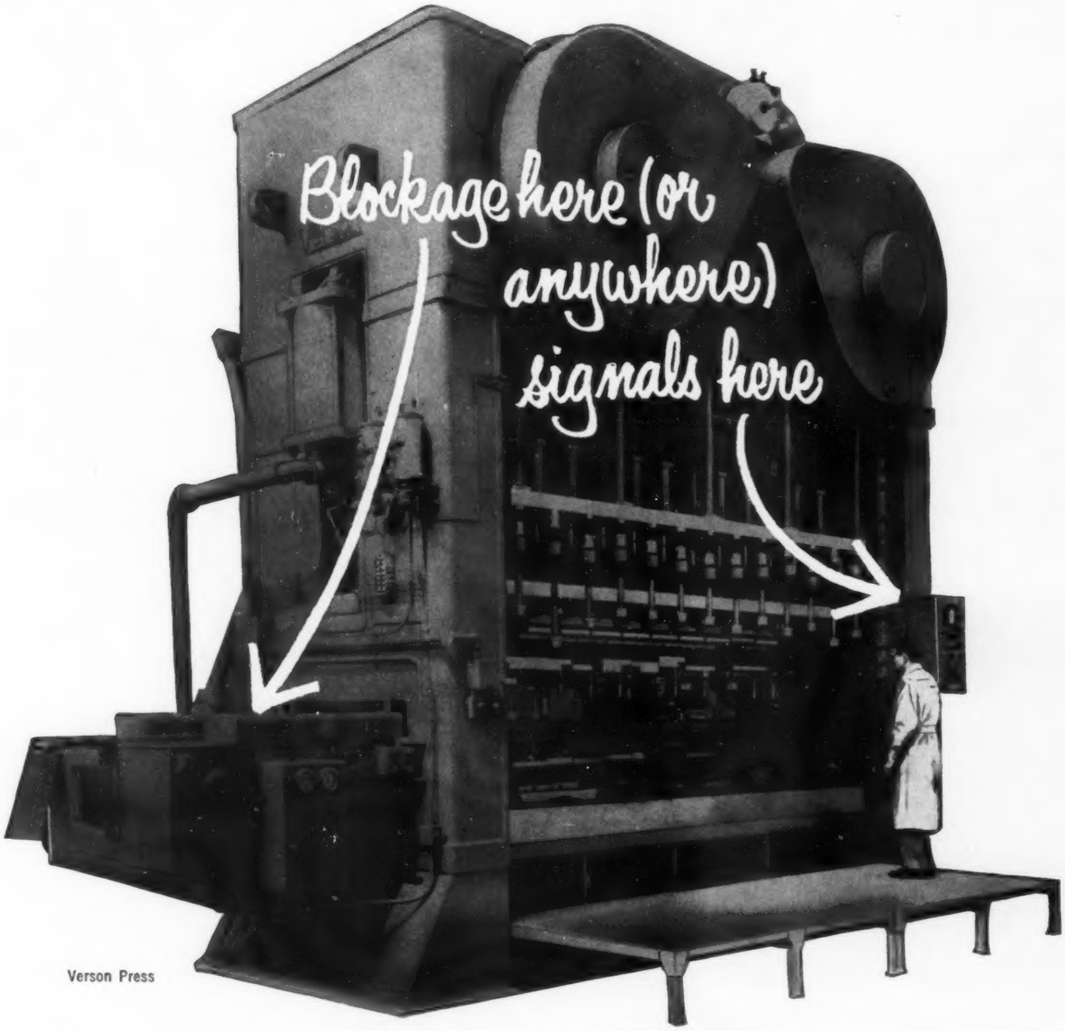
For more details, or for new Facilities File Folder call or write today.

TMW

TEXTILE MACHINE WORKS
CONTRACT DIVISION, READING, PENNA.

TRABON®

CENTRALIZED LUBRICATING SYSTEMS



Verson Press

Trouble around the corner? Trabon warns you!

First with **Centralized Warning** — Trabon gives you a **truly centralized** oil or grease system. Blocked bearings located "around the corner" or out-of-sight, telegraph "trouble" to the pump or control station. (And inexpensive Reset Indicators pin-point the blockage.)

Why take chances with your expensive machinery investment? A fool-proof Trabon System of modern design makes sure that every bearing gets a positive, measured shot of lubricant at correct intervals. Your machine will stay on the job producing parts — and profits — for you. And you will also notice a corresponding decrease in power costs, repair costs and lubricant costs. Lubrication is done efficiently, economically **and positively.**

Ask your Trabon representative for a free lubrication survey of your plant.
You will be amazed at how many ways Trabon can save you money.

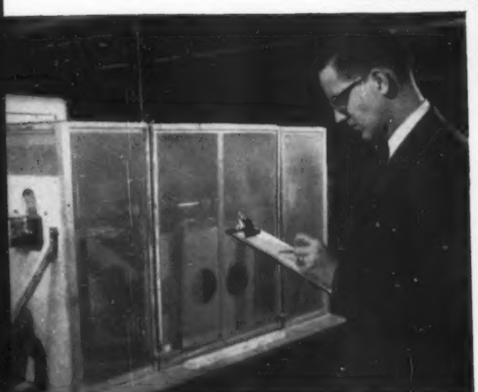
"Centralized" OIL AND GREASE SYSTEMS *"Meterflo"* CIRCULATING OIL SYSTEMS

® *Trabon* **Trabon Engineering Corporation** 28807 Aurora Road • Solon, Ohio

For more data, circle this page number on inquiry card

AIRCO INDUSTRIAL AND RARE GASES

ARGON
OXYGEN
ACETYLENE
NITROGEN
NITROUS OXIDE
HYDROGEN
CARBON DIOXIDE
HELIUM
XENON
KRYPTON
NEON



THE FIRST STEP in making transistors at Sylvania is the zone refining of germanium ingots carried out in a horizontal induction furnace. The required hydrogen-nitrogen atmosphere is supplied by Airco. Impurities, which migrate to one end of the molten bar, are cut off after cooling, and a pure polycrystalline bar of germanium is obtained.

AIRCO INDUSTRIAL GAS SERVICE IS PART OF THE PICTURE

when Sylvania makes precision transistors

Today, the electronics industry, aircraft and missiles, steel, chemicals, food processing and many other industries require vast supplies of industrial gases.

In fact, many of industry's most spectacular products and processes are possible only because of industrial gases. A case in point—the transistor picture-caption story told here.

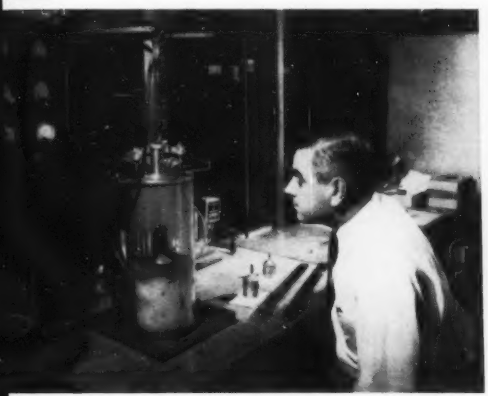
In the use of industrial gases, dependability of supply and service is of prime importance. Airco is a dependable, nation-wide supplier of industrial gases. These include:

OXYGEN • ACETYLENE • ARGON • NITROGEN • NITROUS OXIDE
HYDROGEN • CARBON DIOXIDE • HELIUM • ZENON • KRYPTON • NEON

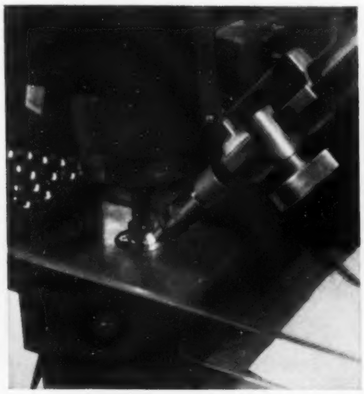
The Airco Technical Service Organization is in a position to design the equipment required for advanced processes and precision products that involve industrial gases. It will help you work out efficient and economical applications. Airco also supplies a complete range of welding and cutting equipment and electrodes—all Airco-designed.

If you are interested in improving a product or process . . . need an especially tailored grade of gas . . . are considering the advantages of a permanent installation, you will find Airco Gas Service fits your needs precisely.

Call in your nearby Airco Engineering Service Representative and talk it over.



NEXT IN THE PROCESS, a single high purity crystal is grown from the polycrystalline germanium. It is a critical step, performed in a vertical induction furnace, with an inert atmosphere of Airco gas. The resulting crystal—99.999999% pure—then is sliced into miniature dice—the heart of a Sylvania transistor.



TRANSISTOR NEARS COMPLETION. Germanium wafer has been formed and fixed. And here a circular precision weld is made on deoxidized copper, joining cap and base. Equipment is the fully automatic Airco Heliweld unit. Electrodes, Airco Thortung. Shielding gas, Airco argon.

THE PERMANENT industrial gas installation at Sylvania, designed and serviced by Airco. Like the many other Airco gas installations, this one is assurance of high purity . . . dependable supply . . . utmost economy.

AIRCO®

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AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO**—industrial gases, welding and cutting equipment • **AIRCO CHEMICAL**—vinyl acetate monomer, vinyl stearate, methyl butynol, methyl pentynol, and other acetylenic chemicals • **PURECO**—carbon dioxide—gaseous, welding grade CO_2, liquid, solid ("DRY-ICE") • **OHIO**—medical gases and hospital equipment • **NATIONAL CARBIDE**—pipeline acetylene and calcium carbide • **COLTON**—polyvinyl acetate, alcohols, and other synthetic resins.

• production of stainless steel parts increased over 6 times with Clausing-Colchester Hydraulic Profiling Lathe...

HERE'S PROOF OF PERFORMANCE

"Our Clausing Hydraulic Profiling Lathe increased production of some stainless steel parts as much as 6 times. It's a rugged lathe for its size . . . dependably accurate, easy to set up and operate. And, you just can't beat it for the money."

Valley Machine Products
Elkhart, Indiana

The new Clausing-Colchester profiling lathes are actually two machines in one, providing automatic duplication *plus* the versatility of a standard geared-head lathe. You can machine multiple diameters, tapers, 90° shoulders, bevels, radii, grooves, chamfers and undercuts to the same accuracy as the template – saving time, money, and eliminating rejects. Moving the hydraulic control lever engages tool with work or withdraws it for standard lathe operations – there's no loss of time shifting from one machining function to another.

Profiler tool slide and hydraulically operated angle slide are mounted on rear of carriage cross slide, with hydraulic slide 60° to axis of lathe bed. Angle slide is powered by an integral hydraulic cylinder. Support centers for templates are mounted at rear of lathe bed. Motor, pump, and reservoir are integral.

Lathe features include: big work capacities with large spindles, tapered roller bearings with oil flow lubrication, tapered key-drive spindle nose, enclosed geared headstock and quick-change box with oil-bath lubrication, hardened bed ways, 13" 15" and 17" models with choice of straight or gap bed. Prices start at $3677. Write for illustrated literature.

CLAUSING

CLAUSING DIVISION
ATLAS PRESS COMPANY
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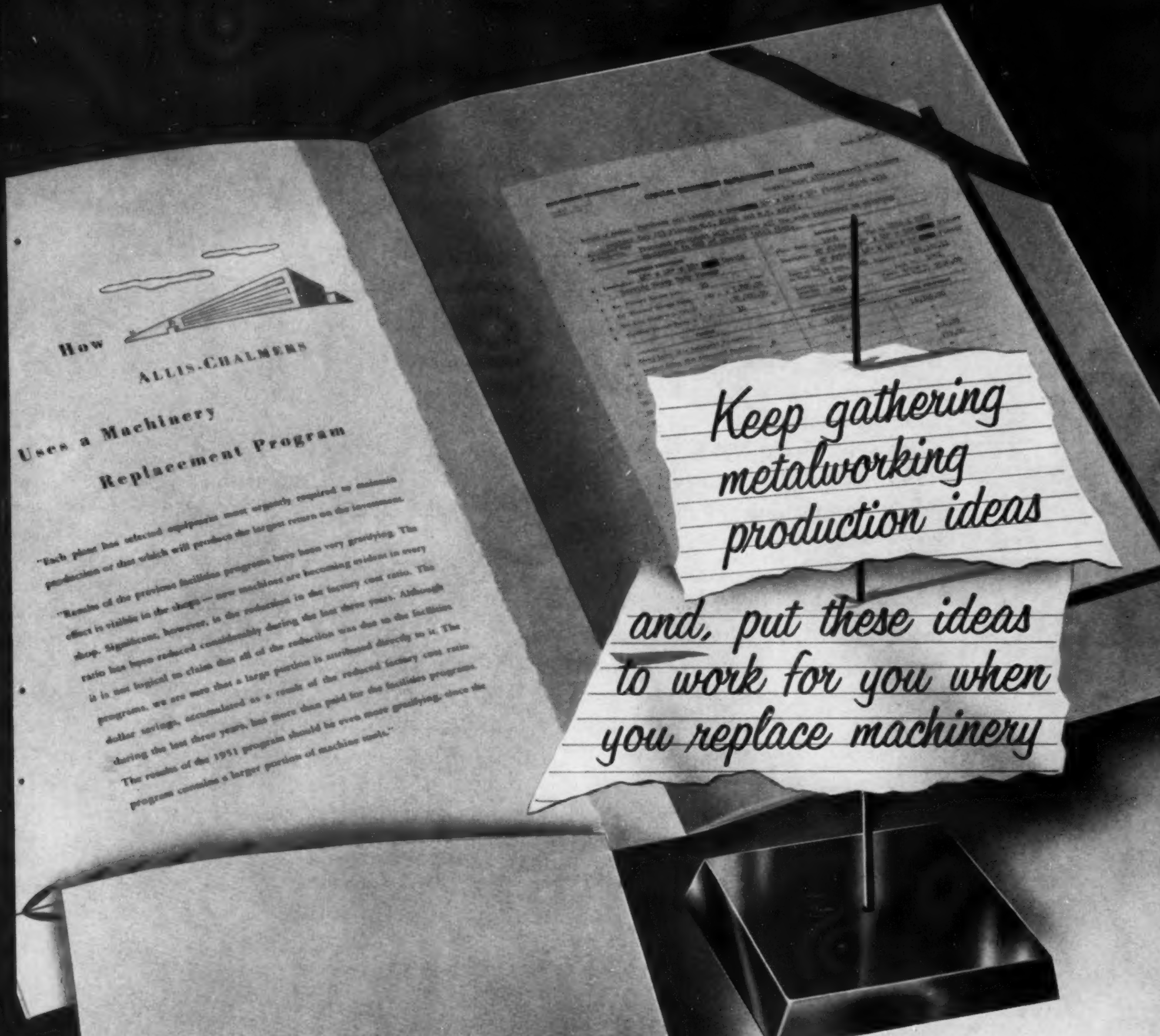


For more than 25 years the members of this group have presented metalworking ideas every month.

In addition, since 1951, we have presented the views of prominent manufacturers concerning scientific machinery replacement programs.

If you haven't written for this book we urge you to do so. It contains examples and comments from eighteen industrialists who have successfully inaugurated scientific replacement programs in their plants. Merely write to any one of the manufacturers in this group.

ROCKFORD INSERT GROUP

Here is how Sundstrand lathes combined with "ENGINEERED PRODUCTION" cut turning costs

There's no better way to guarantee lowest piecepart costs and highest work quality than to provide the right combination of: 1. the best tooling method and, 2. best machine solution. Applying Sundstrand "Engineered Production" to your production turning job is the surest way to satisfy both these basic needs.

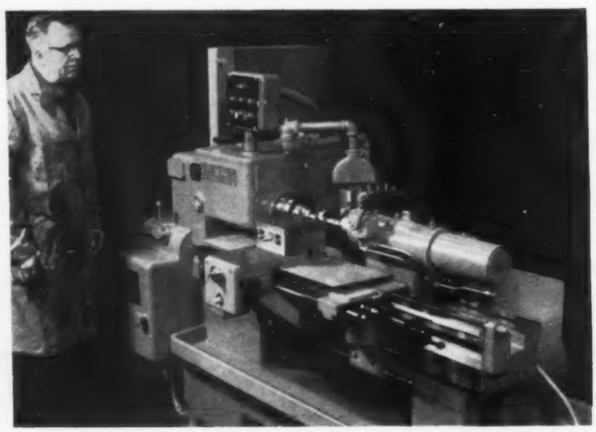
Sundstrand designs and builds a wide range of machines and backs them up with an almost unlimited variety of attachments and the tooling experience gained in numerous "Engineered Production" solutions. Your job may call for small-lot, long-run, tracer, or special turning. Whichever category it falls into, Sundstrand offers you a solution that is "just right."

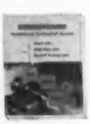
You don't have to pay for more machine than you need or be satisfied with a machine that doesn't quite do the job. Special engineering costs are held to a minimum since even when semi-standard or special machines are required, Sundstrand designs make use of numerous standard elements.

Before you decide on how to handle your turning job be sure you have a Sundstrand solution to compare with present or contemplated methods. A part print or sample part, plus a statement covering your production requirements, is all it takes to get a Sundstrand "Engineered Production" analysis. You incur no obligation, so why not be sure the solution is the best available?

Small Lot Turning

Pump rotors in six different sizes are turned and faced at an average of 190 pieces per hour at 100% efficiency. Tools on the front slide turn three diameters while tools on the rear slide are arranged to straddle-face the rotor body. Change-over to accommodate the different part sizes is quick and simple.





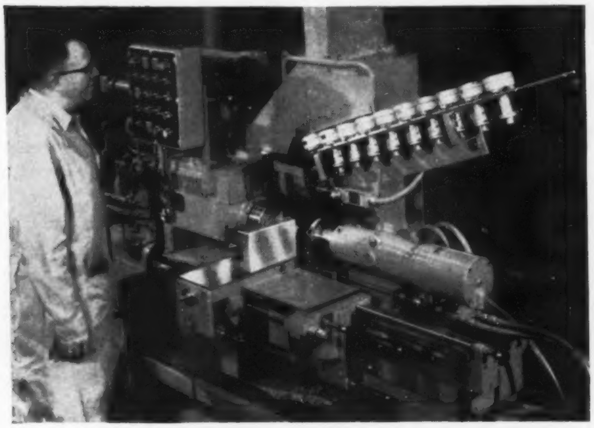
MORE DATA — *Sundstrand "Engineered Production" solution to over 20 turning problems are offered in Bulletin 610. Write for your copy today.*

"Engineered Production" Service

SUNDSTRAND

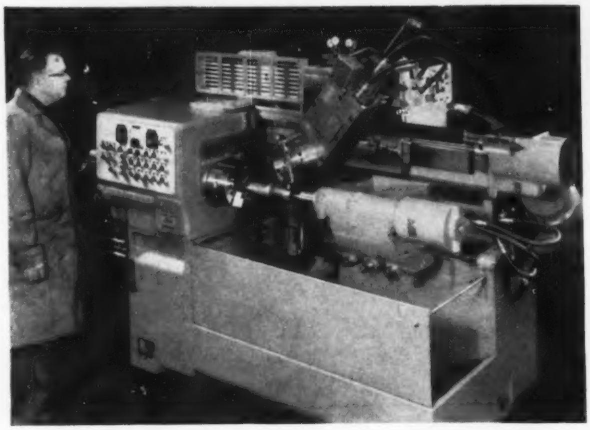
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Long Run Turning



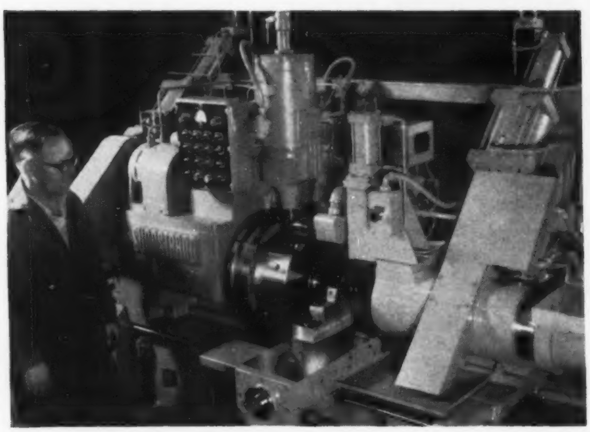
Automatic loading and ejection of work is provided on this Sundstrand automatic lathe. Production of die-cast aluminum housings is approximately 420 per hour with operations including turning the locating diameter and facing flange. This standard machine has a completely automatic cycle that includes part loading from hopper and ejection of finished workpiece.

Tracer Turning



Up to three roughing cuts and a finishing cut are handled with a single template on the Sundstrand tracer lathe. The part shown is a shaft turned from a rough forging with two setups being required to finish both ends. Dial indicators on top of the tracing carriage permit roughing cuts to be set accurately. Finishing cut is .020 inch.

Special Turning



This special lathe drills, bores, and chamfers differential carriers as well as turning each end, turning and chamfering pilot, and facing the flange on the large end. A total of 26 carbide tools are provided. Front and rear slides hold the turning tools with boring attachments through both the tailstock and spindle. Machine has automatic cycle except for manual loading and unloading of workpieces.

SUNDSTRAND MACHINE TOOL

DIVISION OF SUNDSTRAND CORPORATION

BELVIDERE, ILLINOIS

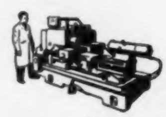
SUNDSTRAND

More facts about

SUNDSTRAND

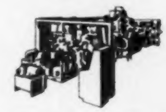
"Engineered Production"

Literature listed under various machine types has more details. Write Sundstrand for your copy today.

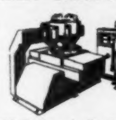


Automatic and Tracer Lathes Bulletin A-110

Engineered Milling Production Bulletin B-110

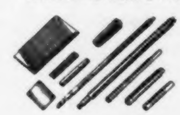


Examples of Transfer Machines—Bulletin C-110

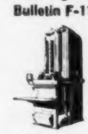


Multiple-spindle Drilling Machines—Bulletin D-110

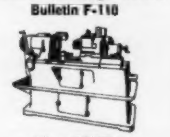
Internal and Rotary Surface Grinders—Bulletin E-110



Broaching Tools Bulletin F-110



Practical Broaching Methods Bulletin F-110

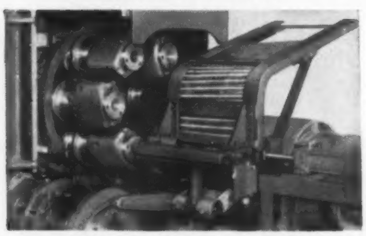


Thread Milling Bulletin G-110

Second Operation

PRODUCTION MACHINERY
GREENLEE

MAGAZINE LOADING



REAR LOADING MAGAZINE

HAND LOADING

A Method of Machining That Pays Off

Greenlee standard Automatic Bar Machines, adapted for second operation work, profitably machine a wide variety of parts. Long shafts or short pieces are automatically loaded into the work spindle by any of the various loading arrangements shown. Parts are loaded in one position during the machining cycle, and machined in the remaining five cross slide and end working positions. For more information, see your Greenlee Distributor.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Die Casting Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

WRITE FOR CATALOG No. A-405

GREENLEE
BROS. & CO.

1744 MASON AVE.
ROCKFORD, ILL.

CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

Grinding through hard scale at 7½ cubic inches per minute eliminates hidden costs

MATTISON HIGH-POWERED PRECISION

GRINDING METHODS

Fig. 1—Tough outer scale and chilled edges on these hot-rolled steel bolster plates and eccentric straps made them costly to mill.

Fig. 2—Surface grinding not only reduced costs but improved finish and accuracy. Stock removal is between .040" and .060".

Grinding versus machining: Clearing's solution to cost problems

If you have flat surfaces to machine, particularly parts having tough outer scale or hard spots, there may be an idea here for you in the way Clearing Division of U. S. Industries, Inc., avoids unnecessary costs by grinding instead of milling.

The flat shape of these 1015 hot-rolled press parts (above) made them difficult to clamp on a milling machine, but the real problem was tough outer scale and burned edges. Cost of cutter replacement was high. Downtime and hidden costs for sharpening were the real reasons Clearing engineers switched from milling to high-powered surface grinding.

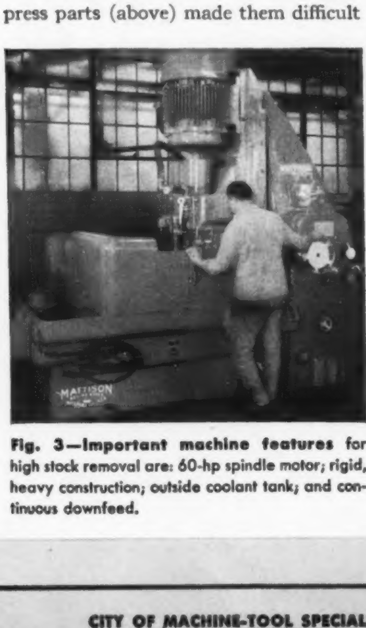


Fig. 3—Important machine features for high stock removal are: 60-hp spindle motor; rigid, heavy construction; outside coolant tank; and continuous downfeed.

Fig. 4—Setup costs were reduced because no clamping is required as with cutter-type machining.

A 60-hp spindle motor was specified to increase grain penetration and chip size. High downfeed and coarse, open-structure wheels produced the desired "self-sharping" action, and a high-detergent water soluble was used to keep wheels free-cutting. Rapid circulation of cutting fluid through Mattison's separate coolant tank eliminated any "heat barrier" under the spindle.

With quick-change segments and self-dressing action, downtime was virtually eliminated. The machine cuts through outer scale "like butter"—at the rate of 7½ cu. in. per min.

Surface grinding solved Clearing's cost problem and increased quality. Why not investigate this low-cost stock-removal method on your jobs?

New, Quick-Tilt Spindle

A new power-tilting device for Mattison No. 24 and 36 vertical-spindle rotaries permits you to combine the advantages of stock removal and precision grinding. A flick of the switch changes the spindle from tilted to perpendicular in seconds. With the help of this new feature, we are producing perfect diamond finishes and increasing production by as much as 50% on parts having large, uninterrupted surfaces. Ask your Mattison dealer to arrange for a demonstration or sample grind on your piece-parts in the Mattison Methods Laboratory.

MATTISON MACHINE WORKS
Rockford, Illinois Phone WOodland 2-5521

MATTISON — HIGH-POWERED PRECISION SURFACE GRINDERS

Automatic Hobbing

The Multicycle versions of the Barber-Colman No. 6-10 and No. 16-16 hobbing machines are designed for maximum production of mass-produced parts or those which are to be changed at relatively frequent intervals. Automatic cycling is combined with easy setup in these standard machines to which standard units are added. These Multicycle machines are not special machines, but the standard units can be used in various combinations to produce your job most efficiently. These machines can also be equipped for automatic loading when desired.

The machine is easily set up for automatic cycling. None of the Barber-Colman versatility is lost. Jobs can be changed as quickly and easily as ever. After the machine has been set up, the operator unloads, loads and presses the start button. Because of the automatic cycling, these machines are equally adaptable and efficient for the mass production of one specific part.

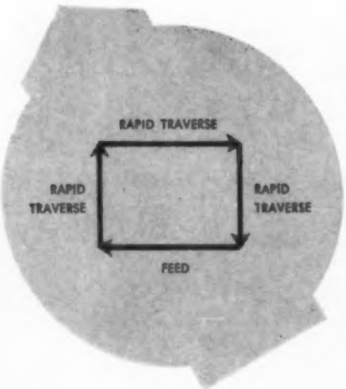
Reduce Approach Time

Approach time is often a high percentage of the total time required to produce a gear.

The plunge-approach cycle is designed to reduce approach time to a minimum. The horizontal feed is engaged at the start of the cycle so that the desired helix angle will be cut. The work feeds vertically into the hob until it reaches full depth. The vertical feed changes constantly from a fast feed at the beginning of

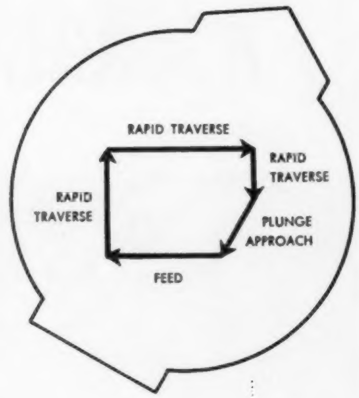
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Any one of these automatic cycles can be selected simply by turning a switch on the control panel.



SQUARE CYCLE — automatic version of the conventional hobbing cycle.

PLUNGE CYCLE — automatic vertical feed for cutting worm gears.



PLUNGE-APPROACH CYCLE — combination of "plunge" and "square."

. . . with typical Barber-Colman versatility

the cut to a slow feed as the hob reaches full depth. The vertical feed and rapid traverse are controlled by the vertical feed cam. The rate of vertical feed is infinitely variable.

The plunge-approach cycle allows the use of larger hobs with more flutes or threads without an increase in approach time. More flutes can be used for greater accuracy and higher production, and more threads will normally result in an increase in production. This cycle can be used advantageously for cutting blind worms or blind gears.

Square and Plunge Cycles

These machines can be set up for square cycle with conventional or climb cut in either direction, and for plunge cycle for worm gears. Cycling is completely automatic for both arrangements.

Get Multicycle Production Estimate

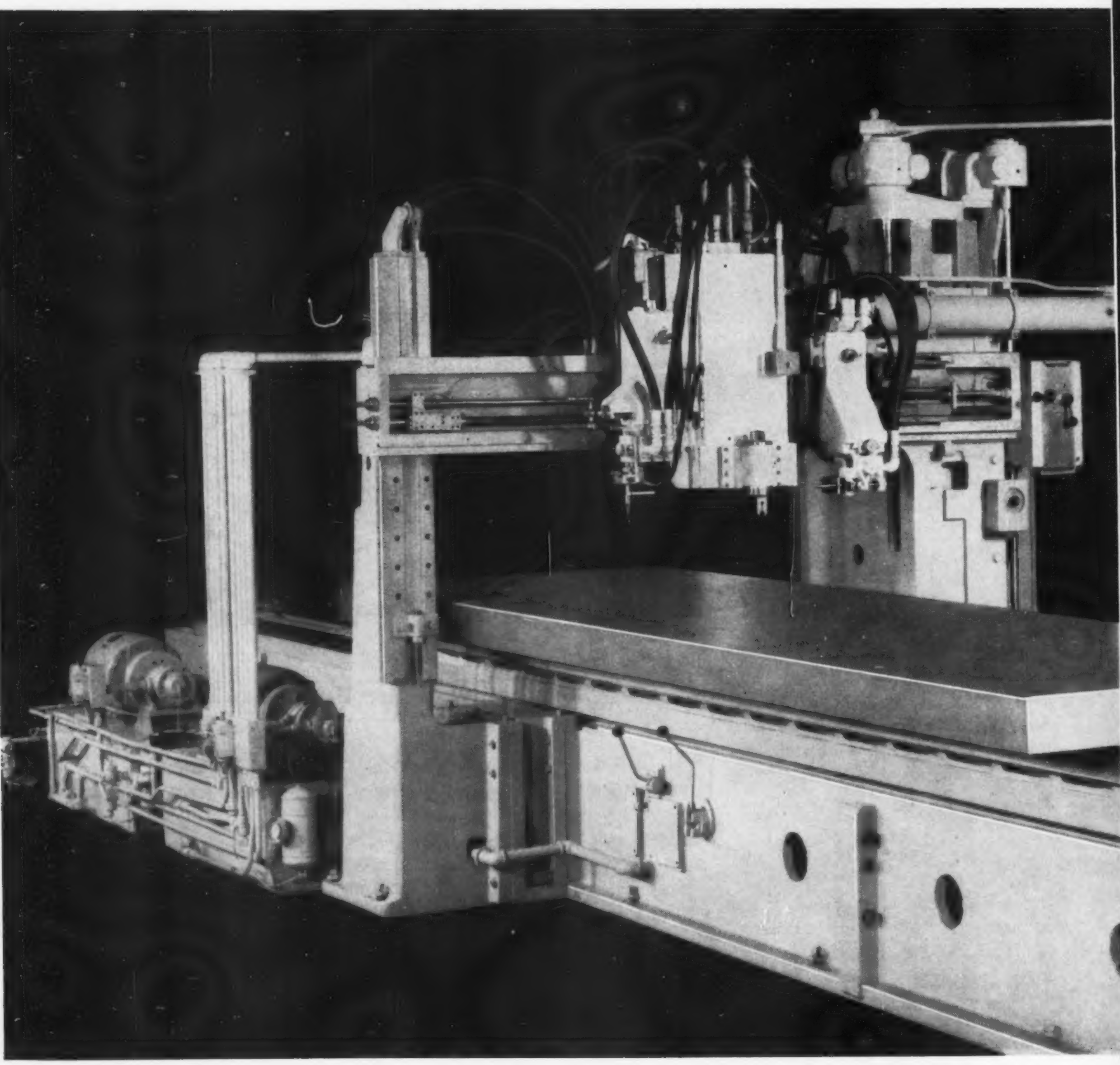
Send us your gear prints for a production estimate on a Multicycle machine. Call your nearest Barber-Colman field office or the factory, WO 8-6833.

Barber-Colman Company

BARBER COLMAN ®

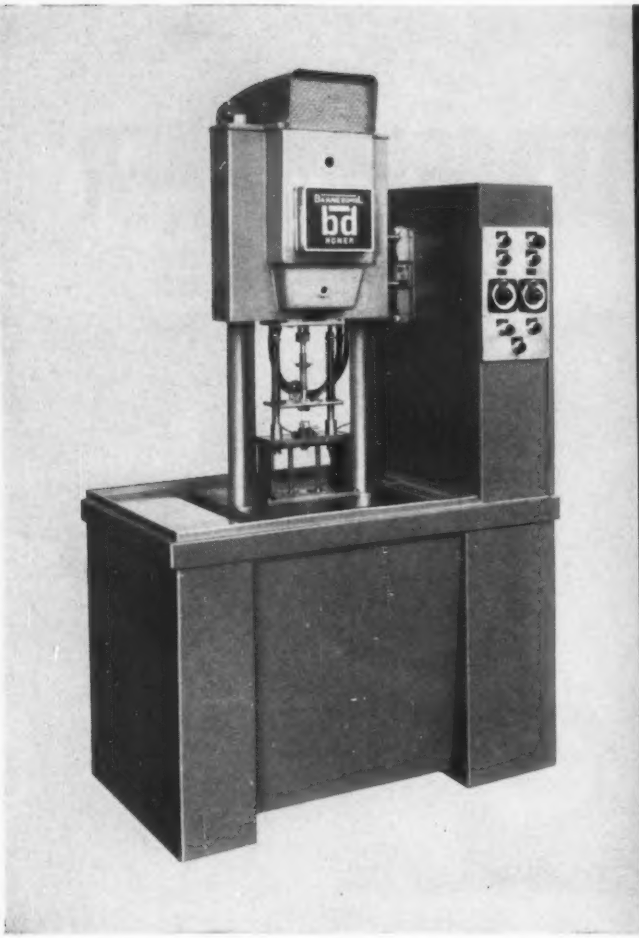
122 Loomis Street, Rockford, Illinois

Nothing does the job like a...



FOR HIGH PRODUCTION OR SHORT RUNS . . .

NEW LOW-COST HONING

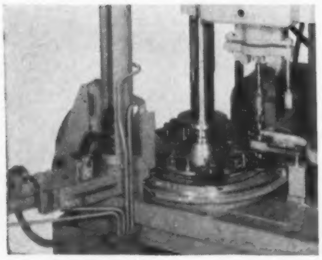


Here is a truly economical machine for low-cost honing of parts with bores ¼" to 1½". For either high production or short runs, the Model 10 BarnesdriL Honing Machine is accurate, compact, and simple to operate.

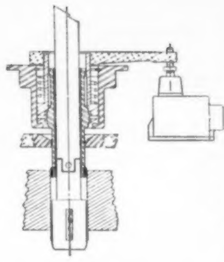
Model 10 single spindle vertical honing machines are designed for either manual loading or complete automation, for handling small parts rapidly and efficiently. Simplicity of fixturing permits economical changeover to different-sized parts. BarnesdriL Plugmatic Sizing maintains bore-to-bore sizing consistently within .0002".

Pneumatic controls govern hone feed, including the full cycle of automatic expansion, collapse, and compensation for stone wear. Both floor space and maintenance costs are held to a minimum through the absence of hydraulic circuitry. For a complete description of this versatile, economical machine send for bulletin No. 550.

Manually-loaded No. 10 machine for honing bearing rod ends, .4995" to 1.003" bores, with stock removal of .006"/.008". Production, 131 pieces per hour, 80% efficiency.



Automatic fixturing on a Model 10 Automatic-Load Machine is shown here. Machine is available with air-operated 6-station rotary index feed dial, and can be furnished with a variety of automatic equipment, including magazine loading, automatic ejection, pre-gauging, post-gauging, automatic shut-off for stone replacement, and sorting for limited rejection of parts.



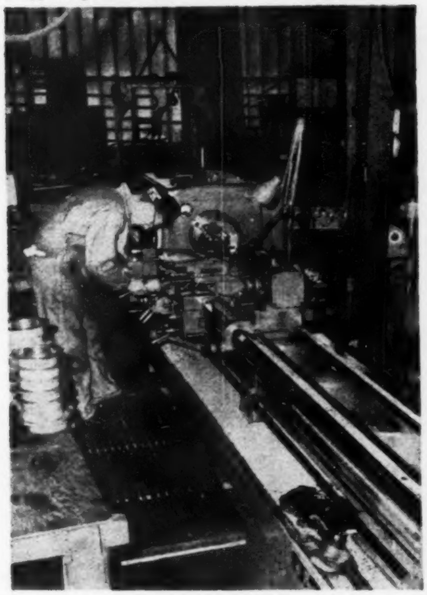
All BarnesdriL Honing Machines are equipped with Plugmatic Sizing for outstanding accuracy. This system gauges only on the bore diameter itself, consistently maintaining accuracy of .0002" bore-to-bore on size.

For Controlled Finishing with Consistently Close Limits of Accuracy and Rapid Stock Removal, Use BarnesdriL Honing Equipment.

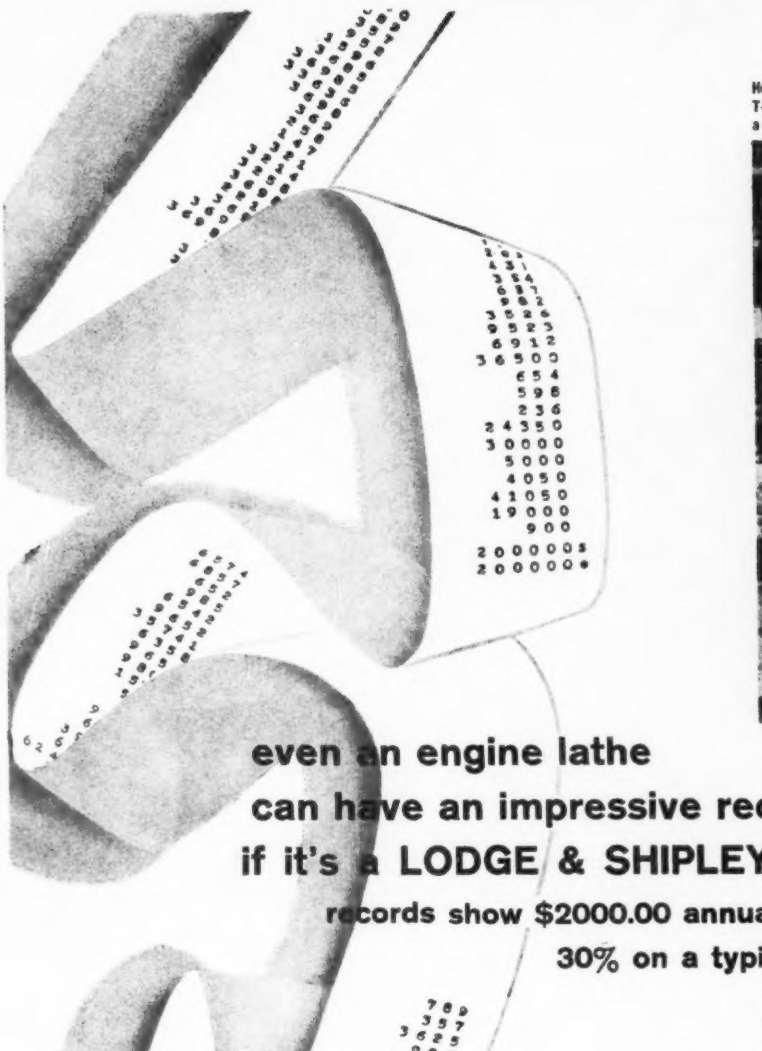
BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



Here, a slip joint collar is being turned and bored from a T-6 aluminum blank. Floor-to-floor time is only 25 minutes, a 30% saving in time alone.



even an engine lathe can have an impressive record of savings if it's a LODGE & SHIPLEY POWERTURN

records show $2000.00 annual saving . . . 30% on a typical operation

Significant savings are nothing new on production type lathes but it is something to write home about on an engine lathe. Tacoma Boatbuilding Co., Inc., Tacoma, Washington, liked the accuracy, versatility and output of their POWERTURN Lathe . . . found impressive savings even when this engine lathe was used for non-repetitive operations.

Whatever your turning requirements, consider Lodge & Shipley. Your needs can be filled precisely from a complete range of sizes and types . . . Production, Engine, Toolmaker, Gap, Hydraulic Tracer Controlled and Right Angle Chucking Lathes . . . all designed to provide the best machine for a specific job.

Check Sweet's Machine Tool File, your telephone book Yellow Pages or write direct for literature: **The Lodge & Shipley Company, 3057 Colerain Ave., Cincinnati 25, Ohio.**

Your Lodgical choice . . .

Lodge & Shipley

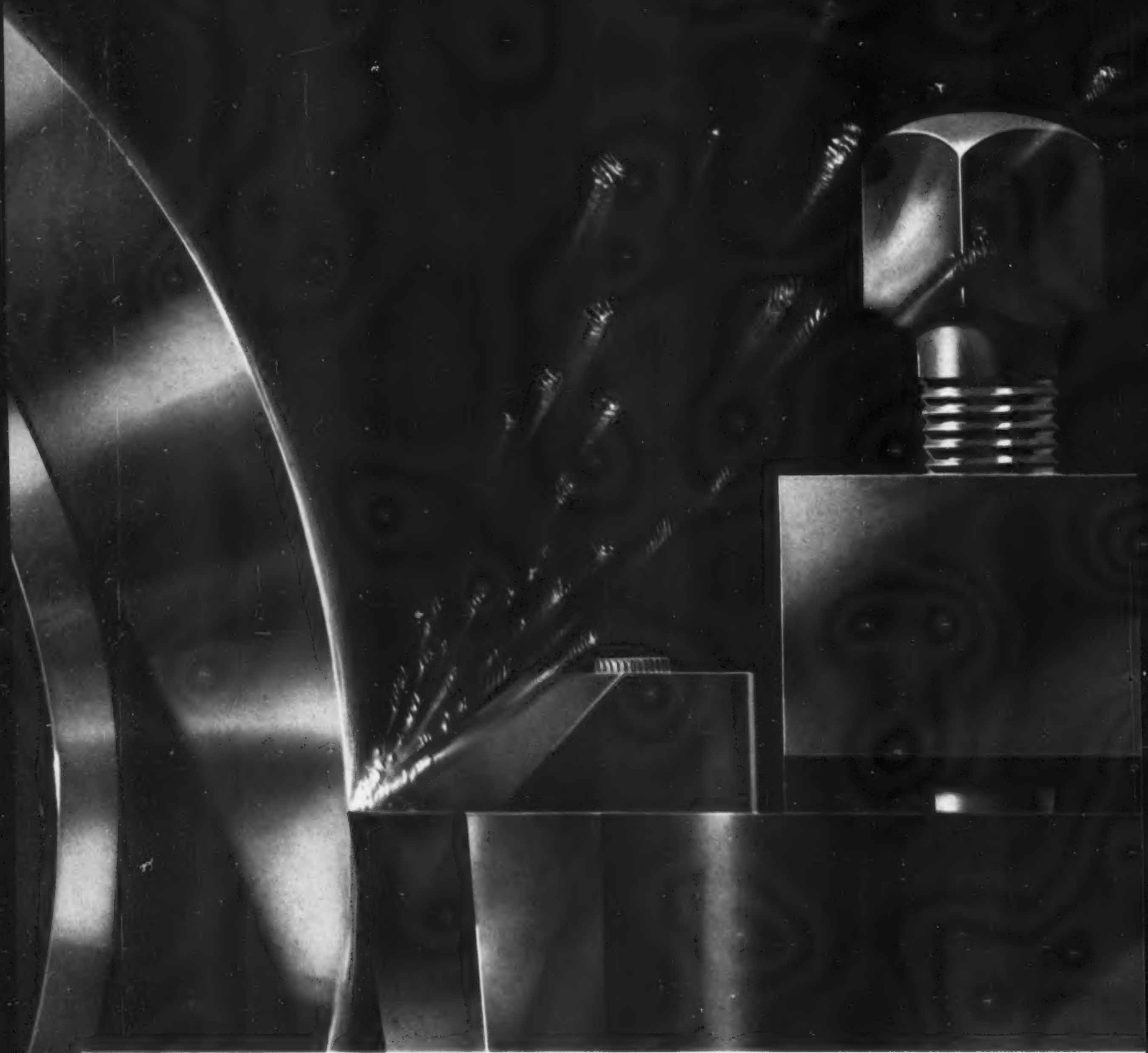


Illustration of Malleable casting being turned at 1,400 surface feet per minute with a 0.100'' depth of cut using an oxide tool.

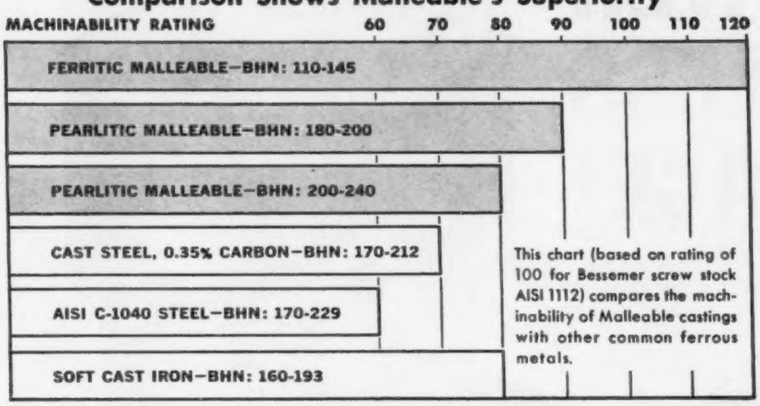
Machining Malleable Castings—Important Key to Cost Reduction

Malleable castings—the most machinable of all ferrous metals—cut quality components costs

Production men know that machining time, power consumption and rejects drop with the use of Malleable iron castings, while tool life and profits shoot up. The reason is simple: Malleable iron is the most machinable of all ferrous metals of similar properties.

The following important factors work together to give Malleable such machining superiority: Malleable's microstructure contains tiny, evenly distributed nodules of carbon that help cutting tools quickly break the removed metal into small (Class A) chips; the carbon also acts as a lubricant, prolonging tool life; uniformity of properties throughout every casting permits running at optimum machining conditions.

Comparison Shows Malleable's Superiority



Typical Example Shows Savings of 70% to 250%

The conversion of automotive universal joint yokes from steel forgings to pearlitic Malleable castings typifies the savings provided by Malleable castings. Costs for the rough pieces and performance characteristics of the two materials are comparable. However, the castings are much more economical to machine. Considering that machining often costs two to four times as much as the rough parts, the economy resulting from using Malleable castings is substantial.

Conversion of this universal joint yoke to a Malleable casting increased production, lowered direct and tool room labor, and cut tool replacement.

One volume user of Malleable joint yokes reports the following savings after changing from steel to Malleable castings: 70% longer tool life in broaching the splines; 250% more pieces cut by the nut seat cutters; 149% more pieces in turning and facing the hub; an increase of 100% in production between wheel dressings in grinding the hub; 246% greater production in drilling the cross holes.

In each of these operations, the change to Malleable castings cuts direct production time by reducing the frequency of tool changes. Tool room labor and tool replacement are both reduced to fractions of their previous costs.

Throughout the metalworking industry, part after part is now being initially designed of Malleable or converted from other materials to take advantage of Malleable's unrivalled machinability . . . to produce better parts at lower costs.

New Information Now Available on Machining Malleable

Data Unit 106—Machinability of Malleable Castings—can be obtained from any member of the Malleable Castings Council, or from the Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

These companies are members of the

MALLEABLE CASTINGS COUNCIL

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck
New Haven Malleable Iron Co., New Haven 4

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Link-Belt Company, Indianapolis 6
Muncie Malleable Foundry Co., Muncie
National Mall. & Steel Castings Co., Indianapolis 22
Terre Haute Mall. & Mfg. Corp., Terre Haute

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW JERSEY
Meeker Foundry Company, Newark 4

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Canton Malleable Iron Co., Canton 5
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
Maumee Malleable Castings Co., Toledo 5
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

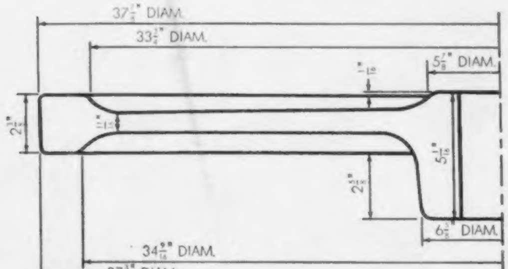
WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

This gear now costs $35.24 less,

THANKS TO BETHLEHEM CIRCULAR FORGINGS

GEAR *installed in hoist mechanism of Koehring Company power shovel.*

EXCELLENT *response to induction hardening? Take a look!*



NOTICE *the thin disc shape on this 395-lb gear blank. A cinch on the Slick Mill!*

"We are also very pleased with product machining properties, freedom from defects in the tooth area, and excellent response of the forging to heat treatment."

KOEHRING COMPANY, MILWAUKEE, WISCONSIN
manufacturers of construction equipment

Koehring Co. previously machined this gear from a cast gear blank. Today they machine it from an impression-die steel forging made on Bethlehem's unique Slick Mill. They save $29.24 in first cost, plus $6.00 in machining costs! (Turning, boring, facing, and hobbing teeth.)

Here's how we do it

The answer, of course, lies in Bethlehem's Slick Mill—the only one of its kind in the country. Quick die set-up (only 15 minutes)—quick operation (just one minute to forge and roll a circular product)—low die charges (1/3 to 1/2 less than conventional impression dies)—and less steel needed (utilizing the principle of forging design, the Slick Mill can produce lighter-weight sections without sacrificing strength) . . . all these add up to important savings. At the same time, the process insures *soundness*, *excellent grain flow*, and *machinability*.

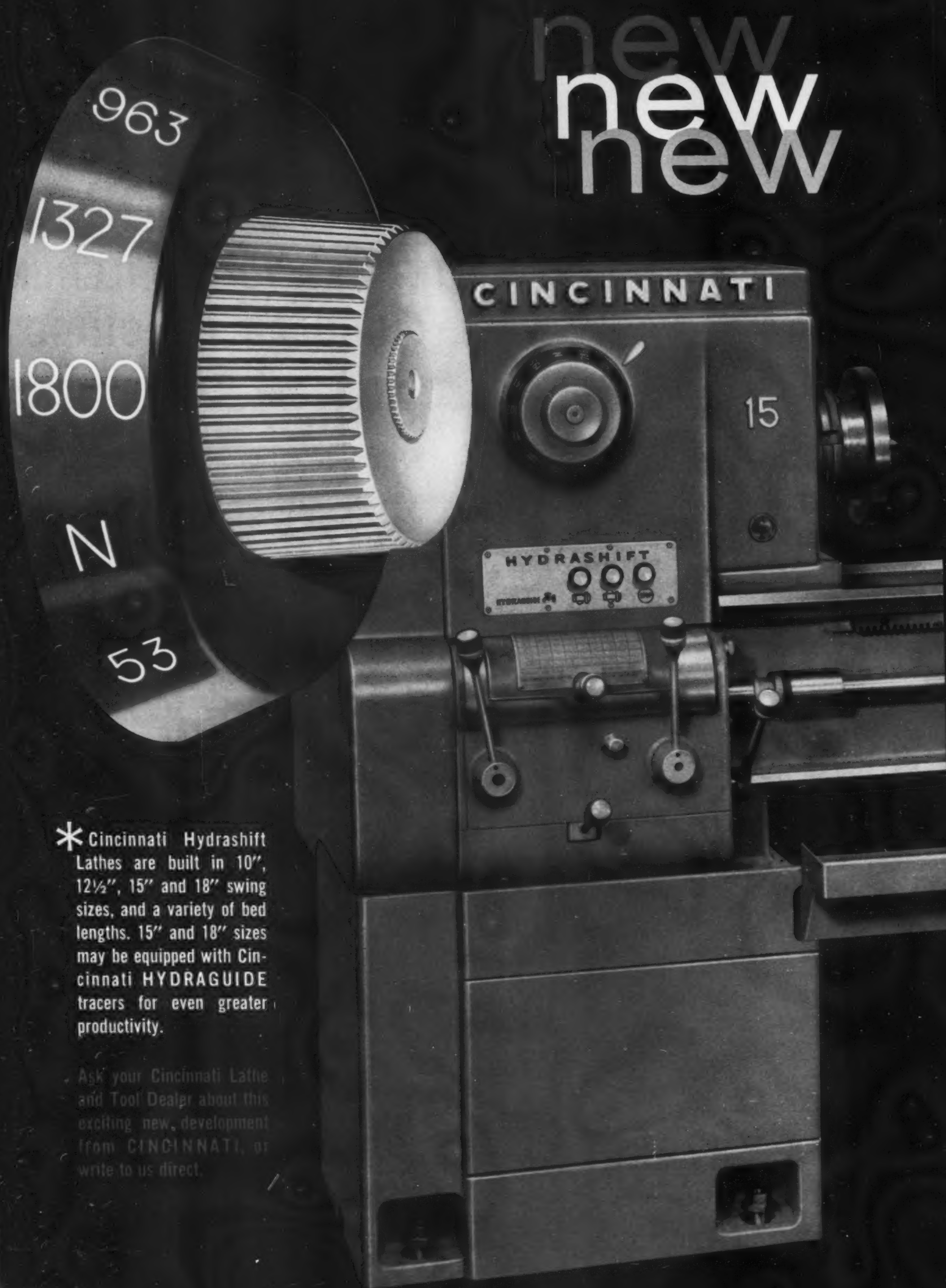
Bethlehem's Slick Mill saves the Koehring Company $35.24 *per gear*. How much can it save you?

Bethlehem Circular Forgings are available in carbon, alloy, or stainless steels, as well as certain heat-resistant grades. 10 to 48-in. OD. 100 to 2,000 lb. As-rolled, or rough-machined to specifications. Call or write the Bethlehem sales office nearest you for full details.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL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from cincinnati lathe and tool

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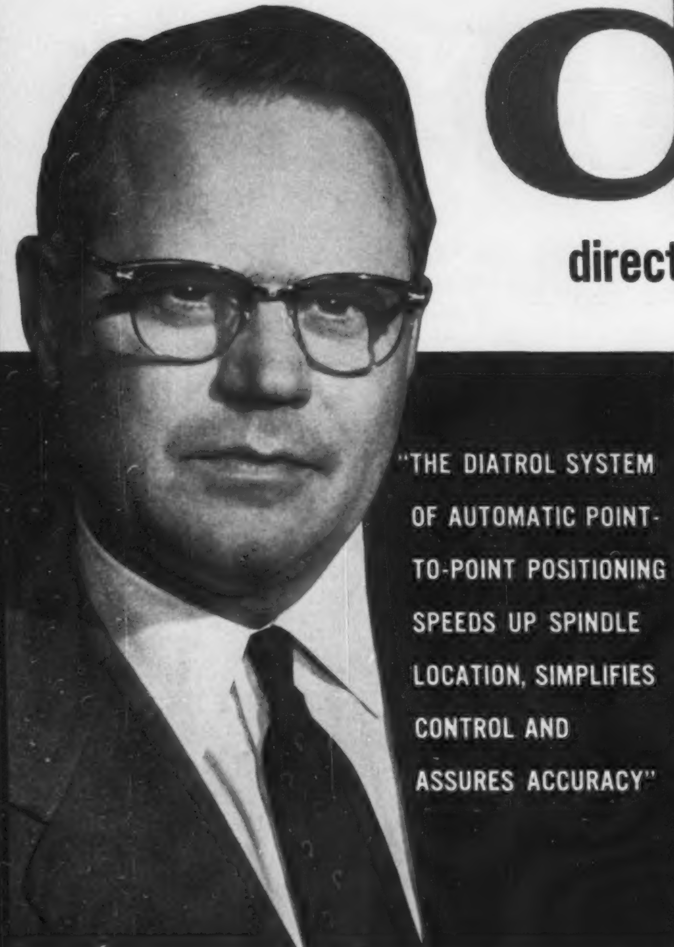

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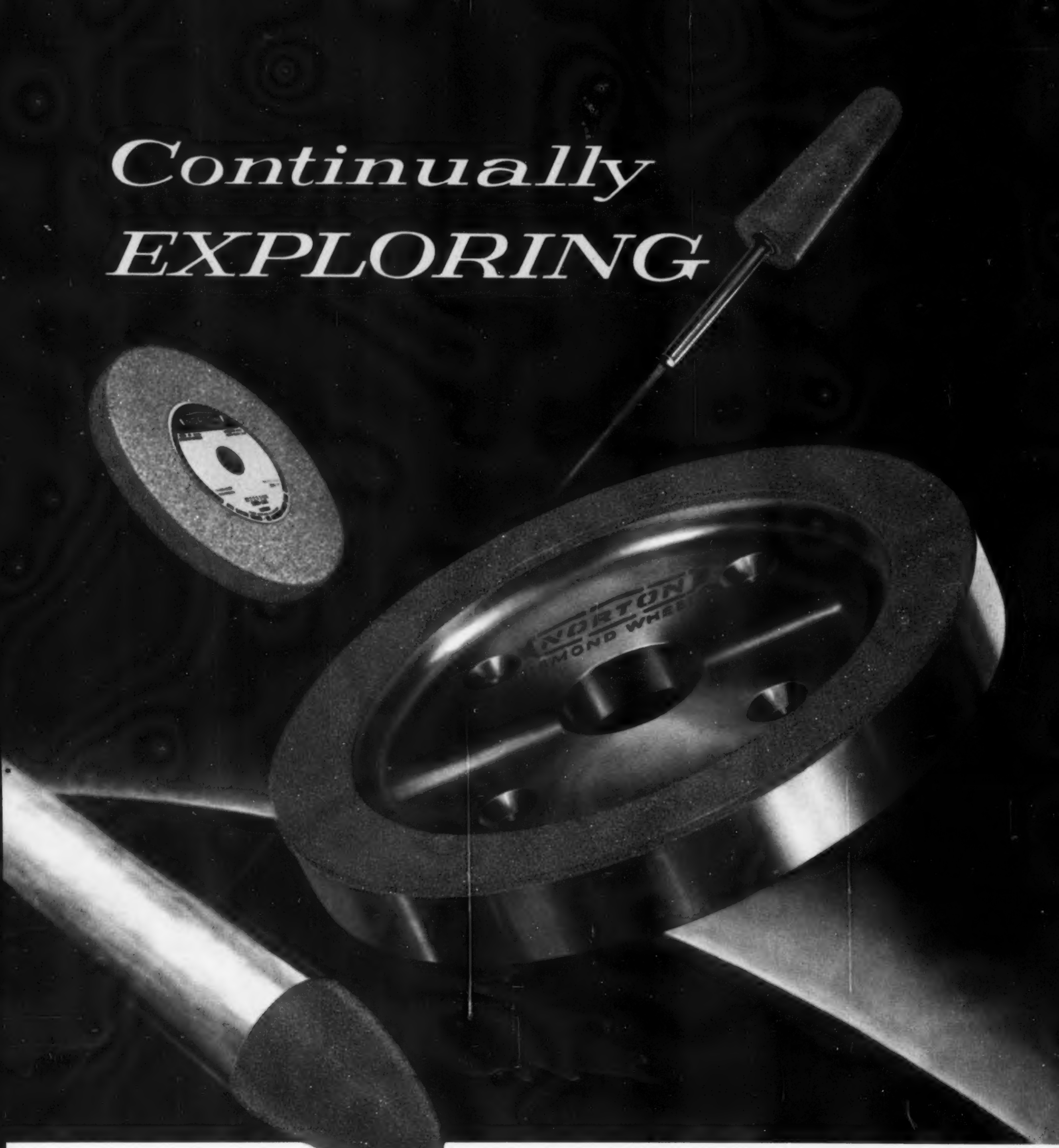

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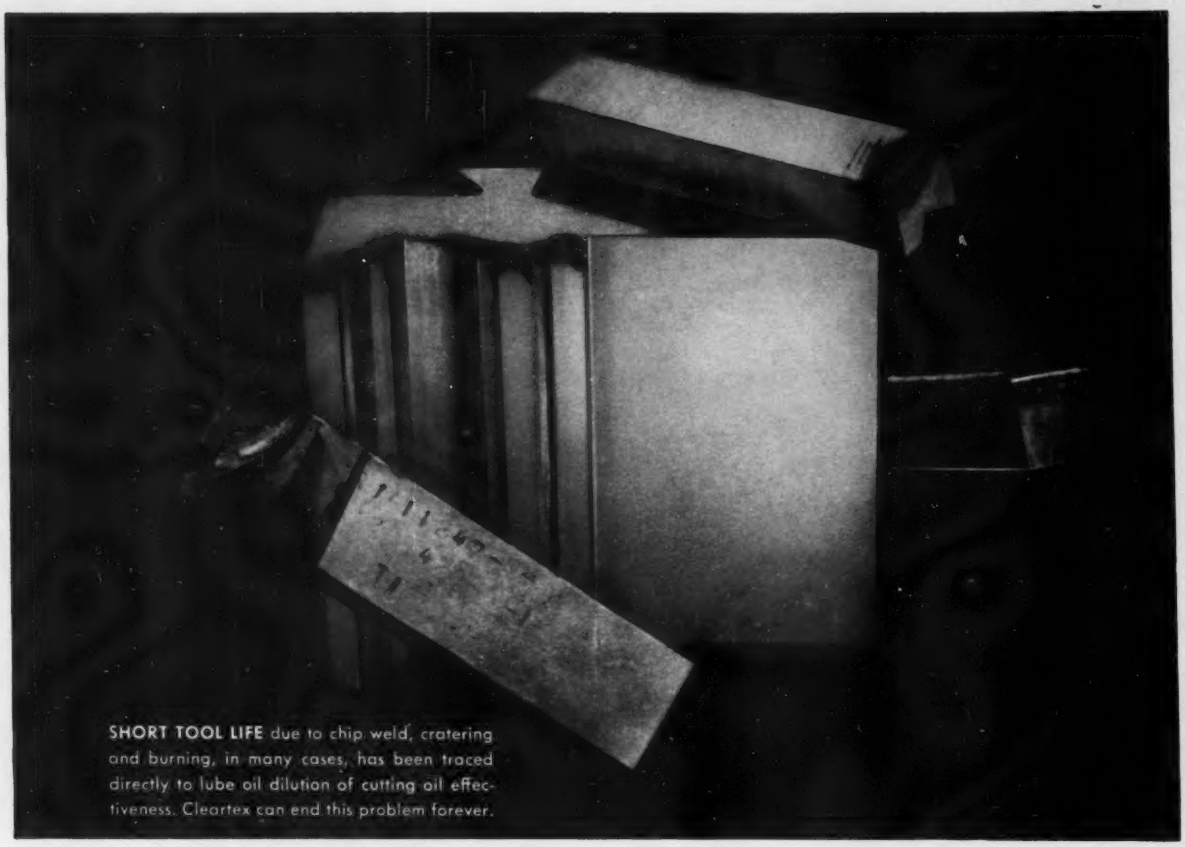

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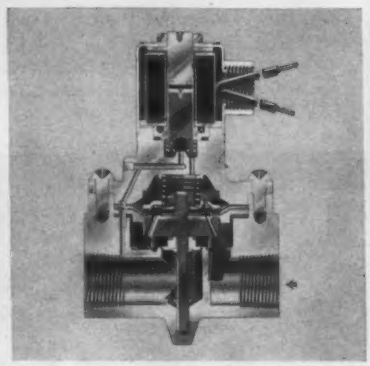
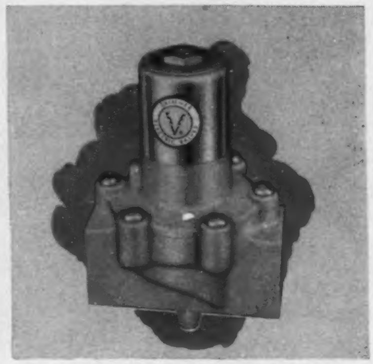
Skinner 2-way Solenoid Valves provide High Flow at Low Cost

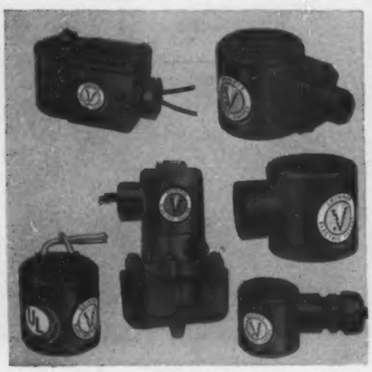
Unusually low-cost model... the LC2 valve. A small, light, normally closed valve. Permits full flow through 1/2" orifice with 3/8" or 1/2" NPT ports. Will control all common media: air, oil, water, etc. Handles pressures from 5 psi to 150 psi, with temperature ranges from minus 40°F to plus 180°F, and will operate on all popular AC and DC voltages.



Features of L Series valves. Like all Skinner valves, these are built to UL standards. Their bodies are made of forged naval brass and their internal parts are stainless steel and brass. Soft, synthetic inserts and seals provide bubbletight operation. And a unique, Buna-N coated nylon diaphragm assembly assures long life. They mount in any position directly to the line. A variety of coils for common AC and DC voltages is available.



Full extent of line includes L2 models featuring 1/2" orifice with 3/8" or 1/2" NPT ports, 3/4" and 1" orifices with 3/4" and 1" NPT ports. At greatly reduced cost, these valves permit applications not possible before. They are available normally open or normally closed in standard or explosion-proof construction.



Custom installation can be had with these options. There is a large selection of electrical housings that can be rotated 360° for easy connecting. Also available for these L2 valves is manual override that permits opening or closing of the valve in the event of a current failure.

For quickest service, write for Skinner's Nationwide Stock List. It covers all of the valves universally stocked by Skinner distributors and includes a number of the L Series valves. From this list, your local Skinner distributor can quickly meet your requirements.

A complete line. There's a Skinner solenoid valve for almost any flow application with a wide variety of media: air, oil, water, inert gases, hydraulic fluids, kerosene and gasoline. Orifice sizes range from 3/64" to 1". Pressure ratings range from vacuum to 3000 psi. Explosion-proof models are UL approved for Class 1, Group D and Class 2, Groups F and G.

Skinner solenoid valves are distributed nationally.

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- Steel "Gray Market" Concerns Washington
- Military Priorities Order Issued
- Over-All Machinery Outlook Favorable
- Rapid Write-Off Tax Deadline
- Washington Briefs

Keeping up with Washington

Loring F. Overman

DURING the latter part of October, Washington received anguished reports of a fast-growing "gray market" in steel. By mail, telephone, and wire, steel fabricators and machinery manufacturers were citing examples of "special offers" involving much-needed supplies at marked-up prices. Official Washington conceded its lack of legal authority to cope effectively with such situations.

"Only an aroused public opinion," said one government official, "will encourage Congress to pass legislation which would authorize action to settle such controversies without seriously affecting the parties involved, the national economy, or the innocent bystander. With 1960 an election year, the voter is in a position to make his voice heard by the Congress which convenes in January." The observer pointed out, however, that the subject stands a better chance of becoming merely an election issue rather than a completed piece of legislation.

Military Priorities Order Issued

Action to ease the pressure on military users of steel, at the expense of civilian users, has already been taken by the Business and Defense Services Administration. Both struck and nonstruck steel mills were directed to accord top priority to controlled materials for urgent defense programs. Nonstruck mills, accounting for 15 per cent of all steel made, were to heed the order at once. Struck mills were to consider it effective upon resumption of production.

Projects particularly favored by the order include ballistic-missile production, missile launching-site construction, and the Navy's nuclear-shipbuilding program.

Over-All Machinery Outlook Favorable

Despite a downturn in the metalworking industries during the fourth quarter of 1959, Washington observers consider the outlook favorable for 1960. Building industries, they anticipate, will be focusing attention on industrial and commercial construction. They point out that tight money may curtail residential construction by as much as 10 per cent in 1960, but that capital expenditures—many of them planned far in advance—can be financed out of reserves set aside for the purpose. The interruption in steel production will not be corrected overnight, they reason, with the result that there will be a scramble to resume business construction as rapidly as possible.

A backlog of orders for certain types of metalworking machinery, particularly the larger units, is also anticipated. One press manufacturer, for example, has been promising delivery dates only on lighter models. The "heavies," he reasons, would exhaust his limited supplies of steel, while enabling him to meet the demands of only a minority of his customers.

Rapid Write-Off Tax Deadline

December 31, 1959, is the final date to certify applications for fast amortization of defense facilities, as provided for in Public Law 85-165. The law placed strict limits on the fast-amortization program and provided that issuance of Certificates of Necessity under the program would end on December 31. The Office of Civil and Defense Mobilization has promised that every possible effort will be made to expedite applications now on hand.

The program was authorized in 1950 to encourage expansion of defense facilities during the Korean War. Under the program, facilities valued at $39,800,000,000 have been constructed by industry, using private capital. Approximately 60 per cent of that total qualified for five-year amortization. Only three highly specialized types of defense production are now eligible for new certification under the program, which once included 229 industrial classifications.

Washington Briefs

Available at the office of Representative Hale Boggs (D.-La.) is a revised draft of his bill (H.R. 5) to provide tax incentives for foreign investment. The bill was generally favored by industry during its consideration at the last session of Congress. Industry wanted to extend provisions of the bill to apply to foreign investment anywhere in the world. The Ways and Means Committee, however, has limited the tax incentives to businesses in Western Europe. Industry may wish to study the revised bill and make recommendations to the next session of Congress.

The Joint Economic Subcommittee on Automation and Energy Resources was told at a recent hearing that the country's electric requirements in 1975 would total 2000 billion kwh (kilowatt hours), as compared with 724 billion kwh in 1958. For the year 2000, a total power generation of 6000 billion kwh was forecast. By that time, 40 per cent will be generated by coal, a small amount by gas, a slightly larger amount by hydroelectric power, and the largest amount by atomic energy. Estimated coal requirements for power production were placed at 600 million tons in the year 2000, with nuclear power in use at the coal equivalent of 850 million tons.

Carl W. Hasek, Jr., an engineer with Babcock & Wilcox, New York City, has been named assistant director of the BDSA's power-equipment division.

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

The Challenge of America's Small Cars

FOR YEARS the big automobile companies pooh-poohed the idea that the American public, or any appreciable segment thereof, would want to drive small-sized automobiles. From the very beginning of the industry, the emphasis had always been on bigger and bigger and more luxurious cars.

Recently, however, the high initial investment, the high cost of gasoline and maintenance, and the difficulty of finding adequate parking space have led to a popular demand for the "undersized" European models. During the last few years, the influx of imported cars became so great that American manufacturers could no longer afford to ignore a definite trend toward cheaper transportation on the part of many car buyers. Actually, about 600,000 cars will be imported during 1959.

Two American companies have been building cars in competition with foreign imports for some time, but now the Big Three are entering this market with so-called "compact" cars which they hope will meet with popular acceptance. These cars are constructed to comfortably seat six passengers and are powered by six-cylinder engines. Various operational advantages are claimed.

Excitement runs high in automotive circles as American manufacturers ready themselves to capture the small-car market. The Big Three have plans to produce close to a million compact automobiles in 1960. In setting up production lines for these new models, wide use was made of machine tools and other manufacturing equipment that was on hand, merely providing different tooling. However, if the sales of the new models meet expectations, it will probably be necessary to install large quantities of the latest types of equipment to meet future needs.

With European labor so much cheaper than American labor, the only way that it will be possible for our manufacturers to sell cars at comparable prices and make a profit will be to apply the most efficient production methods that can be devised. That involves use of the most modern equipment of all kinds. Only by following its time-honored manufacturing progressiveness will our automobile industry be in a position to beat foreign competition.

Several articles describing manufacturing methods applied for compact cars are included in this Automotive Production Number. Other articles deal with operations that turn out the larger automobiles which will, as always, constitute the backbone of this vital industry.

Charles O. Herb

EDITOR

Steel and aluminum users report increased values from Ryerson

These case histories—selected at random from our files, provide additional evidence that you consistently get increased value for your purchasing dollar from Ryerson. Individual points of difference between Ryerson and other sources may not by themselves seem overwhelming—but in total they add up to an important difference in dependability, experience and capacity to serve.

A world famous manufacturer formerly tested all steel purchased from steel-service centers for critical ordnance work. But, often, test costs on small lots of steel were greater than material costs. So the company decided to concentrate its purchases with sources proved completely reliable—and discontinue its own testing. Experience showed that the required certifications of quality were always absolutely dependable in the case of only three steel suppliers—among them Ryerson where quality has been a watchword since 1842.

Milling operation eliminated. A structural fabricator followed the usual practice of milling the ends of beams to be used as column bases until he discovered the accuracy and squareness of Ryerson friction sawing. Now he has eliminated the milling operation because, at no extra cost, Ryerson can guarantee friction saw accuracy of only $\pm$ 1/16″ for beams up to 6″ and $\pm$ 1/8″ for sections over 6″—squareness tolerances of .010″ per inch of section.

Better product appearance and a worthwhile saving in material cost resulted when a Ryerson man recommended that a producer of portable coolers switch from one aluminum alloy (3003-H14) to another (5005-H14). Slightly higher structural strength was a bonus value. Unusually broad aluminum stocks and technical resources often enable Ryerson to serve in this way.

The need was urgent. A breakdown was cutting output of a big paint producer, and the steel needed to repair the break was not available in the area. However, the required analyses and size *was* on hand at the nearest Ryerson plant 200 miles away—and within an hour Ryerson delivered 100′ of this bar stock to the local airport. Three and a half hours after calling Ryerson in another state, the customer had his steel.

"Deeper cut, better finish, longer tool life, and lower total per-piece cost." These were the results reported by a Mass. machining company after it switched to Ryerson Rycut® 40 alloy steel for shafts, gears and spindles used in rugged machine tools. Ryerson Rycut steels are the world's fastest machining in their carbon ranges.

Missile component problem solved. Titanium stringers in stainless forged bars were creating a high reject rate for a missile parts manufacturer. His Ryerson specialist recommended a switch from Type 321 stainless to Type 347. Results: the same stabilized corrosion-resistance and strength—but no titanium stringers.

Furniture manufacturer saves 15¢ per unit on every chair produced. A *rolled* aluminum angle was being used where strength was not an important factor. A Ryerson aluminum specialist suggested an *extruded* angle which gave all the strength needed in the application, was more easily formed, had better appearance—and reduced costs as well.

These are just a few examples that illustrate the advantages that make Ryerson service truly unique. A call to your Ryerson representative may solve similar problems for you.

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Automotive Production 1960

Chrysler Valiant

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Machinery

December 1959

Vol. 66 NO. 4

Ford Falcon

Dawn

tooling for next year's automobile crop takes shape in Chrysler's modern die-making facilities

RAYMOND H. SPIOTTA
Associate Editor

# of a New Model Year

LIKE A FAMILY PORTRAIT showing two generations side by side, the Chrysler stamping plant in Twinsburg, Ohio, displays two generations of automobiles—the current model being produced on its twenty-eight major press lines and the tooling for the model year to come being shaped in its large, well-equipped tool and die department. About 60 per cent of the various dies used on some 260 presses are turned out in this die shop, making the stamping plant practically a self-contained production operation.

Preliminary Operations on the Raw Castings

Raw die-castings arrive at Twinsburg from several local and distant foundries. Depending on their intended application, they may be of steel, Meehanite, or Strenes metal. After a preliminary inspection, the castings are brush-painted a particular color, denoting the model year in which they are to be used—blue for 1960, orange for the compact Valiant, buff for 1961.

To facilitate manipulation of these heavy castings, the first metal-cutting operation is the drilling and tapping of handling holes. This is shown being done on a Carlton horizontal drill press in Fig. 1. In this instance, the Swift-Ohio rotary table in front of the machine spindle is loaded with smaller castings: The one being drilled is a cam-driver unit for a '61 die. The spindle head on the drilling machine has a vertical travel of 6 feet, and the upright column can move along horizontal ways for a distance of 12 feet. Holes in planes other than horizontal can also be drilled since the head can be tilted through an arc of 45 degrees.

All castings for dies and die parts are laid out by hand. This can be quite a task with the larger members, such as the flanging die for a '61 hood panel shown supported on a surface plate in Fig. 2. Laying out a casting of this size requires approximately sixteen hours. It should be mentioned that, prior to layout, the base and one side of the casting are machined flat and square on a planer type milling machine.

Machining and Contouring

Depending on the complexity of their configuration, die parts are machined to layout lines on either Ingersoll planer type milling machines, such as the one illustrated in Fig. 3, or Keller tracer-controlled milling machines. The outer edges of a '61 trim-die stake are being recessed to accommodate steel inserts. A single, 100-hp head is driving a 4-inch-diameter cutter having eight helical inserted teeth of high-speed steel. The cutter is run at a speed of 30 rpm while the work is fed past it at a rate of 2 1/2 ipm (inches per minute).

More complicated shapes are handled on a bank of four Keller machines. The one shown in the heading illustration has a horizontal travel of 6 feet and a vertical travel of 12 feet. Here, a bottom binder for a '61 roof panel (bottom) is being aligned with a duplicating plaster (top). At this stage, both the cutter-spindle and the stylus holder contain a pointed rod for picking up the center lines on the duplicating plaster and on the casting.

Both roughing and finishing operations are performed. For rough contouring, a 3 1/2-inch-diameter high-speed-steel cutter is operated at 20 rpm, with a feed rate of 1 1/2 ipm and a 1 1/2-inch progression. During finishing, the same cutter, speed, and feed are employed, but the progression is reduced to 3/4 inch. About 125 to 130 hours are required to complete both the rough- and finish-machining steps.

In Fig. 4 can be seen the rough contouring of a punch for a deck-lid inner panel. This Keller machine is somewhat smaller than the first one illustrated, having a horizontal travel of 5 feet and a vertical travel of 10 feet. Because of the

Fig. 1. (Left) Drilling handling holes in a cam-driver on a horizontal drill press. Followed by tapping, these are the first metal-cutting operations to be performed on the castings.

Fig. 2. (Right) Flanging-die casting for a hood panel is being laid out on a large surface plate. About sixteen hours are required to lay out a casting of this size.

Fig. 3. (Left) A mounting seat for steel inserts is being machined around the perimeter of this trim-die stake. The 4-inch-diameter, inserted-tooth cutter is used on a single, 100-hp head.

Fig. 4. In another setup such as the one shown in the heading illustration, a punch for a deck-lid inner panel is being contoured. Both roughing and finishing cuts will be taken on the work.

many small indentations that must be reproduced, Fig. 5, a 2-inch-diameter high-speed-steel ball end mill is used. For this roughing operation the stylus is 0.180 to 0.200 inch larger than the cutter diameter.

Selection of stylus diameter with relation to cutter diameter is of great importance. An allowance of 0.035 inch is made for deflection of the stylus before its movement is transferred to the cutter-spindle. Therefore, when size-to-size duplication between the plaster and the work-piece is desired, the stylus must be 0.070 inch larger in diameter than the cutter. For example, if a 2.000-inch-diameter cutter is being used, a 2.070-inch-diameter stylus must be used with it.

On the other hand, when a die member is to be cut slightly larger to allow for metal clearance, the stylus might be the same size as the cutter, or perhaps smaller. An example of this would be a case in which a 0.040-inch metal thickness clearance is to be allowed on both sides of the casting. Assuming the same 2.000-inch-diameter cutter is to be used, the size-to-size stylus would have a diameter of 2.070 inches. Subtracting from this a total of 0.080 inch, representing the double metal thickness, the new stylus diameter would be 1.990 inches. To allow for 0.030-inch metal thickness on both sides, a 2.010-inch-diameter stylus would be needed.

After rough and finish contouring have been completed on the Keller machines, the machined surface is covered with parallel rows of shallow grooves, or cutter marks. These, of course, must be removed, and this is done by "barbering" as shown on a '61 hood-panel punch in Fig. 6. Lay-out dye is applied to a small area of the punch and a portable Thor air tool is used in a hand grinding operation to smooth out the surface. A 36-grit wheel is used first, followed by further smoothing with a 60-grit wheel. Barbering a casting the size of this punch usually requires the services of two men for a period of approximately thirty-two hours.

Punch and Die Members Are Spotted-In

Following barbering, the punch is spotted-in. This is done on one of four 30-ton Clearing hydraulic spotting presses having a table, or bolster, 100 inches deep and 200 inches wide. The bolster rests on rails and can be rolled out of the press area for loading and unloading.

Fig. 5. A better view is afforded of the cutting operation being performed in Fig. 4. The presence of many narrow indentations makes it necessary to use a 2-inch-diameter ball end mill.

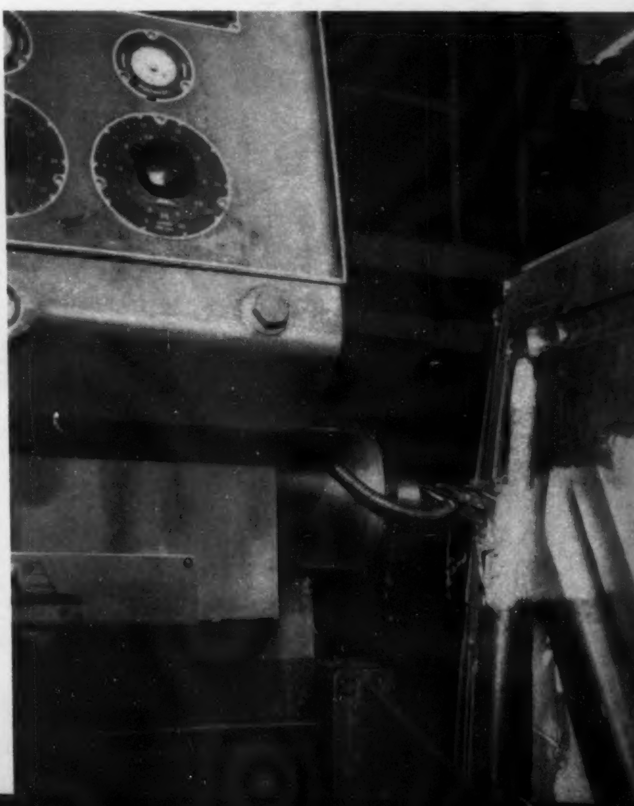


Fig. 6. (Right) Rows of tool marks left by the profiling operation are removed by "barbering." Using hand grinders, two men can barber a casting such as this hood-panel punch in about thirty-two hours.

Fig. 7. (Below) Hand-stoning a station-wagon-roof punch. This is done after the punch has been mastered with a spotting rack, and the die then spotted-in with the punch.

For spotting-in, the punch is mounted on the bolster of the press. A spotting rack is mounted on the press ram. This rack is made of hardwood (usually mahogany) and has a plastic facing. It possesses the exact reverse form desired on the punch because it has been made directly from the master hardwood model of the automobile to be produced.

Prussian blue is applied to the spotting rack and the press is closed lightly, then opened. The punch is then checked for the presence of blue spots which represent the true bearing areas. These high (blue) spots are touched up with a 60-grit abrasive wheel. The process is repeated until an 80 to 90 per cent bearing is obtained. A final step in spotting the punch is done out of the press. This is hand-stoning, as is being done on the roof punch for a Valiant station wagon in Fig. 7. Thirty-six- and 60-grit stones are used in succession.

After hand-stoning, the punch is used as a master for rough-spotting the cavity of the lower binder. It is inverted and mounted in its normal position on the ram of the spotting press in place of the rack. Prussian blue is now applied to the punch surface and the press is closed lightly. High spots in the die cavity are ground down until the desired bearing is obtained.

Fig. 8. An air manifold is being attached to a rear door-panel die. After leaving the spotting press, and before tryout on the main press line, the required automation equipment is installed in the lower die.

Because of the metal-to-metal contact encountered while spotting-in the die member, slight depressions and unevenness occur on the stoned punch surface. This condition is brought out by an operation known as "scaling." Prussian blue is applied to a flexible steel straightedge which is "rolled" across the contours of the punch to highlight surface imperfections. Any slight high spots can be leveled off by further hand-stoning of the punch.

There is yet another step in this chain—the die cavity must be finish-spotted. To do this, the punch and die members are set up in the main press line and tried out with a sheet-metal blank in place. The formed parts must show no signs of surface imperfections or the die cavity will be reworked.

After leaving the spotting press, and prior to the main-line tryout, all necessary automation equipment is installed in the lower half of the die. An air manifold for the two lifters (shown partially raised) is being assembled to a flanging die for a '59 rear door panel in Fig. 8.

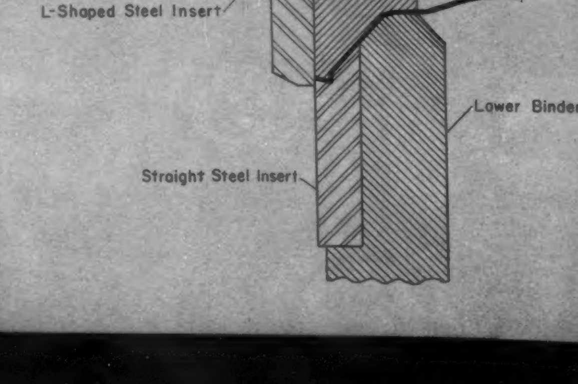
Steel Inserts Are Used on Some Dies

Not all tooling is as simple as the plain punch and die members already described. On trimming and flanging or restrike dies, steel inserts are used to withstand severe wear. Inserts are usually of water-hardening tool steel and are held in place, at an angle of 90 degrees to the trimming action, by bolts and dowels. They are seated against shoulders that have been machined around the perimeter of the die-casting (Fig. 3).

Illustrated in Fig. 9 is a small section of a roof-panel trimming die that uses steel cutter inserts. Seated in the lower binder is a straight insert of water-hardening tool steel. The insert mounted on the trimming punch, however, is of an L-shape. A feature of this L-shaped insert is that it consists of two different types of steel bonded together. The cutter portion that is aligned with the lower insert is water-hardening tool steel—the long horizontal section that is mounted on the trimming punch is soft mild steel.

Dies calling for steel inserts follow the same sequence of operations as do the solid dies, except that the inserts are installed prior to Kellering. Any collapsible cams required in the female die member that would result in a locked-in con-

Fig. 9. Small section of a roof-panel trimming die equipped with steel cutter inserts. The L-shaped insert consists of a mild steel mounting section (horizontal) that is bonded to a cutting member (vertical) of water-hardening tool steel.



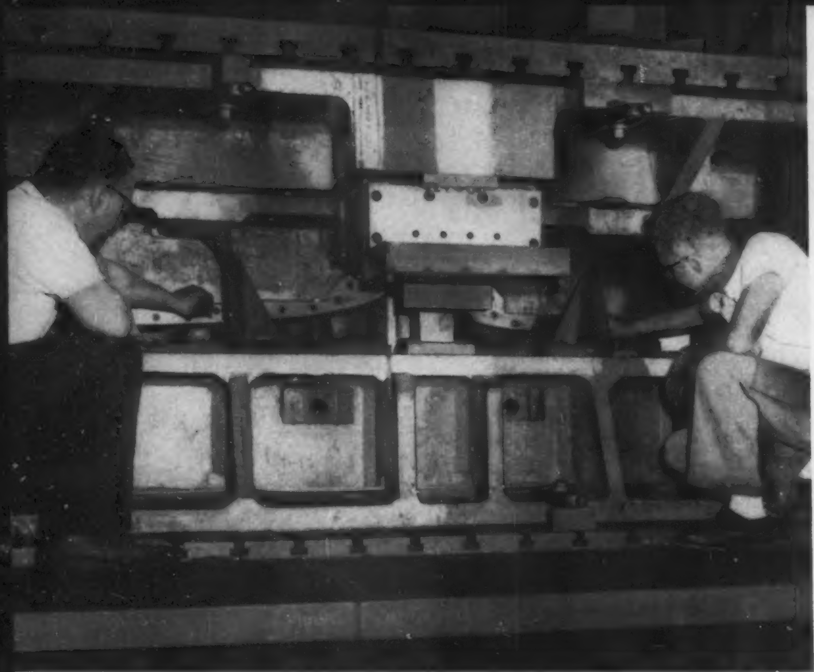


Fig. 10. Checking the timing of the cams and alignment of the steel inserts on a trimming punch and die for roof panels. Tools are mounted on a 30-ton spotting press.

dition must also be constructed and installed prior to Kellering.

Spotting-in of these tools is basically the same as the procedure previously described, but with certain additional steps. As before, the punch member is mounted on the bolster of the spotting press. Because the trimming punch will not sit in the main press in exactly the same position as the drawing punch, the spotting rack must be reskidded, or reset, when it is mounted on the press ram to suit the position, or tilt, of the trimming tools. The inserts are then spotted-in as part of the tool.

When the punch has been spotted, or mastered, it is inverted and mounted on the press ram to replace the spotting rack. First, however, the steel inserts are removed and heat-treated to bring them to the proper hardness. The back faces of the inserts are then blued and worked in with a hand grinder to eliminate heat-treat distortion, after which they are replaced on the punch.

Using the punch as a master, the die member is spotted-in. In Fig. 10, timing of the cams and alignment of the steel inserts are being checked on the trimming punch and die for Valiant roof panels. After checking, the press is opened and the bolster is rolled from between the uprights so that high spots can be relieved (Fig. 11). During this checking of the tools, the L-shaped punch inserts are shifted slightly in order to provide a clearance between them and the straight die inserts of approximately 5 per cent of the sheet-metal thickness to be trimmed.

Fig. 11. The press has been opened and the bolster and trimming die (Fig. 10) have been rolled from between the uprights. Fit of the trim steels is being checked and any tight spots are being relieved.

Pontiac Pinion Production Features Spherical Grinding

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Spherical seats on the back faces of differential pinions are precision-finished—true with the pitch line within plus or minus 0.0005 inch—on special grinding machines. Polishing of the seats and honing of the bores have been added to the processing to improve the quality of the gears

BEVEL PINIONS such as the one seen in Fig. 1 are critical elements of the differentials on Pontiac automobiles. To improve the quality of these important components, closer tolerances and smoother surface finishes have been specified. This has necessitated revising the processing of the pinions to include generating the spherical seats on special grinding machines, polishing the seats, and honing of the pinion bores.

The differential pinions are made from fine-grained, SAE 1022 steel bar stock 2 5/8 inches in diameter. Drilling, reaming, forming, chamfering, and cutting off of the gear blanks are done on Conomatic six-spindle, automatic bar machines. Cutoff ends of the blanks are chamfered on Avey single-spindle drilling machines. The blanks are then washed and inspected.

Straight teeth on the bevel gears are rough- and finish-cut as well as chamfered on Gleason Revacycle machines such as the one shown in Fig. 2. Blanks are loaded, the pinions machined, and the finished parts unloaded in a completely automatic cycle. One man can operate eight machines, since it is only necessary to supply blanks and remove cut pinions about once an hour. Each machine produces eighty-five pinions per hour.

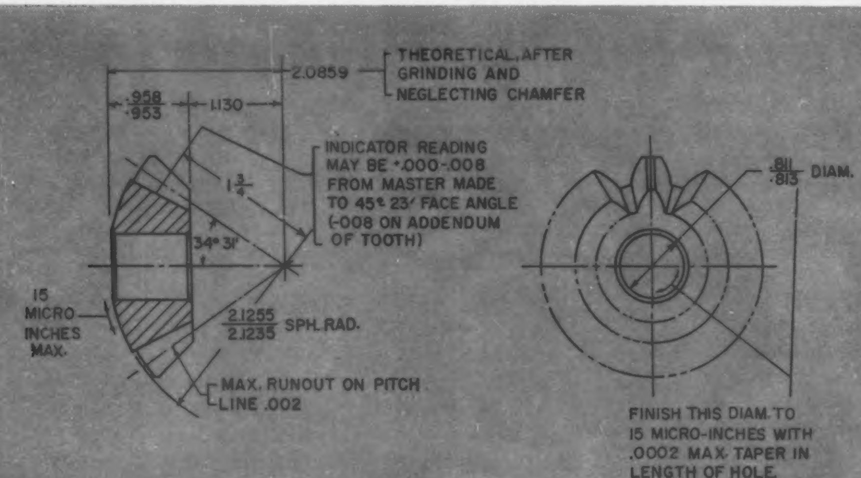
Blanks are placed on the vertical spindles of an indexing loading table, and cut pinions are automatically placed on the verticle spindles of an indexing unloading table. At the start of the automatic cycle, a hydraulically actuated elevator lifts a stack of blanks on one of the vertical spindles. Then, a pair of jaws on a hydraulically operated swinging arm closes to grip the uppermost blank. The arm carries the part into loading position, where it is placed on a hydraulic expanding arbor.

The cutting action in generating the straight teeth on the bevel gears is similar to that of circular broaching. The large-diameter cutter contains radial blades that are arranged to consecutively rough, chamfer, and finish the teeth—one tooth at a time—with the blank being indexed after each revolution of the cutter until the pinion is completed. During rotation, the cutter is moved slightly in a straight line across the face of the pinion being cut, and parallel to its root line, by means of a cam. The direction of motion is reversed when the finishing blades pass across the blank, so that the cutter is returned to its original position at the completion of each revolution.

When the last tooth space in the pinion has been produced, rotation of the cutter is automatically stopped. The part is then automatically unloaded and dropped on one of the spindles of the unloading table. Both the loading and unloading tables index each cycle. After dropping the completed pinion, the loading arm swings back to the loading station to pick up a blank from the next stack, and the cycle is repeated.

The differential pinions are casehardened to a depth of 0.030 to 0.040 inch by carburizing at a temperature of 1650 degrees F. in a Surface Combustion continuous furnace. After quenching in water from the carburizing temperature, the parts are drawn at 375 degrees F. in a Leeds & Northrup furnace. This treatment results in a surface hardness of 61 Rockwell C. Hardened pinions are shot-blasted in a Wheelabrator machine to remove scale formed during heat-treatment. From 0.007 to 0.010 inch of stock is removed from the bores of the work-pieces on Heald and Bryant internal grinding machines.

Generating of the spherical seat on the back face of each differential pinion is done on the special Mattison grinding machines seen in the heading illustration. The spherical surface is



TOOTH DATA

NO. OF TEETH–11 (MATING GEAR–16)		PITCH-CONE DISTANCE	2.1082
PITCH DIAM.	2.3887	OUTSIDE DIAM.	2.751
DIAMETRAL PITCH	4.605	PITCH CONE ANGLE	34°31′
ADDENDUM	.220	FACE ANGLE	45°13′
DEDENDUM	.197	ROOT ANGLE	27°28′
CLEARANCE	.045	VERTEX DISTANCE	1.613
WORKING DEPTH	.372	PRESSURE ANGLE	22°30′
FULL DEPTH	.417	CIRCULAR THICKNESS	.3648

Fig. 1. Spherical seat on back face of this differential pinion is ground and polished, and bore is honed to meet the surface finish and tolerances that are specified.

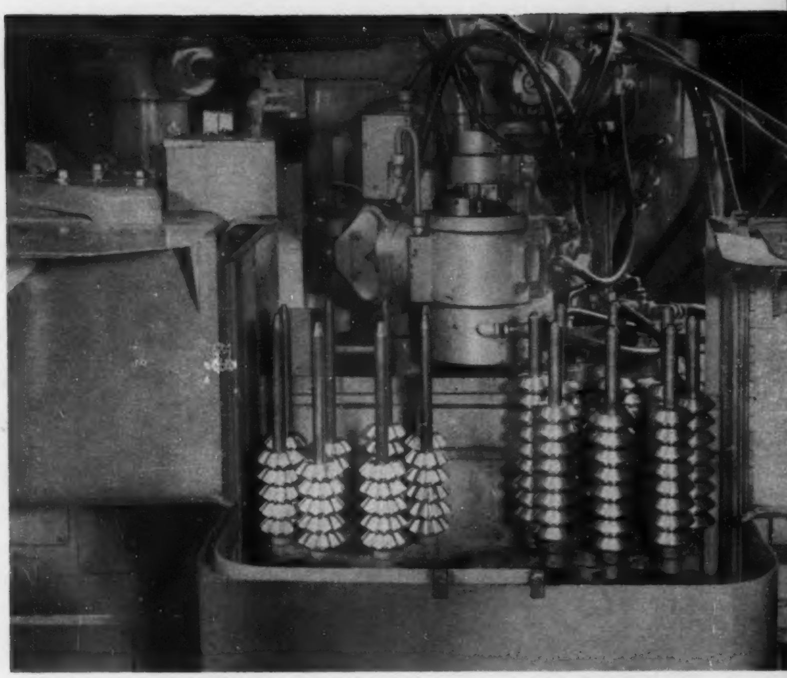


Fig. 2. Gear blanks are automatically loaded and unloaded on this Revacycle machine which cuts and chamfers the teeth.

ground by means of a generating action as the work-piece is simultaneously revolved and oscillated about the center point of the specified radius, Fig. 3. Except for manual loading of the pinions in the magazine, all production functions are performed automatically—including size control and compensation for abrasive wheel wear.

Pinions are manually loaded into the vertical magazine as seen in Fig. 4. The parts *A* (Fig. 5) are aligned by means of a center guide post *B* and two guide pins *C* that fit between the teeth on the pinions. The pinions are automatically transferred, one at a time, from the bottom of the magazine to a position above the chuck by means of an air-operated shuttle *D*. Tooth-space guide pins are also provided on the shuttle, in line with those in the magazine, so that the pinions will drop freely from the stack without binding. A minimum of five pinions must be maintained in the magazine stack to keep the center guide post in the vertical position.

When the shuttle is at the right-hand end of its stroke (the unloading position), a finger *E* extends upward into the bore of the lowermost pinion in the stack and supports the lower end of the center guide post. As the shuttle advances to the left for loading a work-piece (bottom view), the finger pivots downward out of the pinion bore. However, the guide post does not drop because it is supported first by the top surface of the pinion being transferred to the loading position, and then by the top surface of the shuttle as the shuttle completes its loading stroke.

The shuttle deposits the pinion on an ejector ring *F*, which is lowered and raised to load and unload the parts by means of a pivoting arm in contact with a clamping-arm sleeve. When the shuttle is retracted and the ejector ring lowered, the pinion enters a nest type chuck *G*, which locates the part from its pitch line. An expanding rubber mandrel *H* is used to hold the gear firmly in the chuck.

Rotation of the work-spindle is accomplished by a hydraulic motor, through speed-reducing gears. The work-spindle and its drive unit are oscillated in roller-bearing journals by a hydraulic system. In order that the pinions can be loaded in mesh with the teeth on the chuck nest, the work-spindle must be stopped with the nest teeth in register with the loading shuttle. This is accomplished by means of a ratchet and pawl mechanism on the hydraulic motor shaft. When the work-spindle is rotating in a clockwise direction during grinding, the pawl is disengaged. However, when spindle rotation is stopped for loading, the hydraulic drive-motor creeps in reverse, and the pawl is engaged by means of an electric solenoid inside the gear-box.

To prevent oversize or inverted pinions from being jammed under the grinding wheel, an air-operated probe is automatically brought into contact with the pinion in the chuck immediately before grinding starts. An adjustable trip-dog on a rod attached to this probe contacts a limit switch when a properly positioned pinion is seated in the chuck to the proper depth. Failure

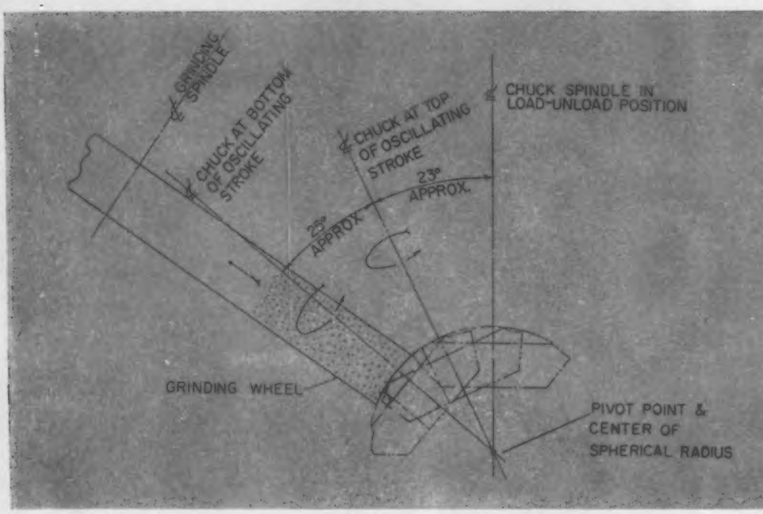


Fig. 3. Spherical seat is ground by means of a generating action as the pinion is revolved while it is oscillated about the center point of the radius.

to actuate the limit switch stops the machine cycle, and the trouble can be corrected without damage.

The wheel-slide containing the grinding spindle and spindle drive-motor moves on ball-bearing ways at an angle of 35 degrees to the horizontal. Movement of the wheel-slide is accomplished with a lead-screw, which meshes with a combination nut and worm-gear. A total movement of 8 inches is provided, 4 inches of which is necessary for normal operation, and the other 4 inches to facilitate changing the grinding wheel. A 6-inch diameter hydraulic cylinder is used as a counterbalance (rather than a gravity weight) to take up any lash in the system.

From 0.008 to 0.015 inch of stock is ground from the spherical seat on each differential pinion in this setup. A resinoid-bonded, aluminum-oxide abrasive wheel of 80 grain size and M hardness, 24 inches in diameter by 1 inch wide, is used. The grinding wheel operates at 6500 sfpm (surface feet per minute), while the work rotates at 210 rpm, making a complete cycle for each pinion of about twelve seconds. The work-piece is oscillated past the wheel about eight times. Dressing of the wheel face to the required concave radius

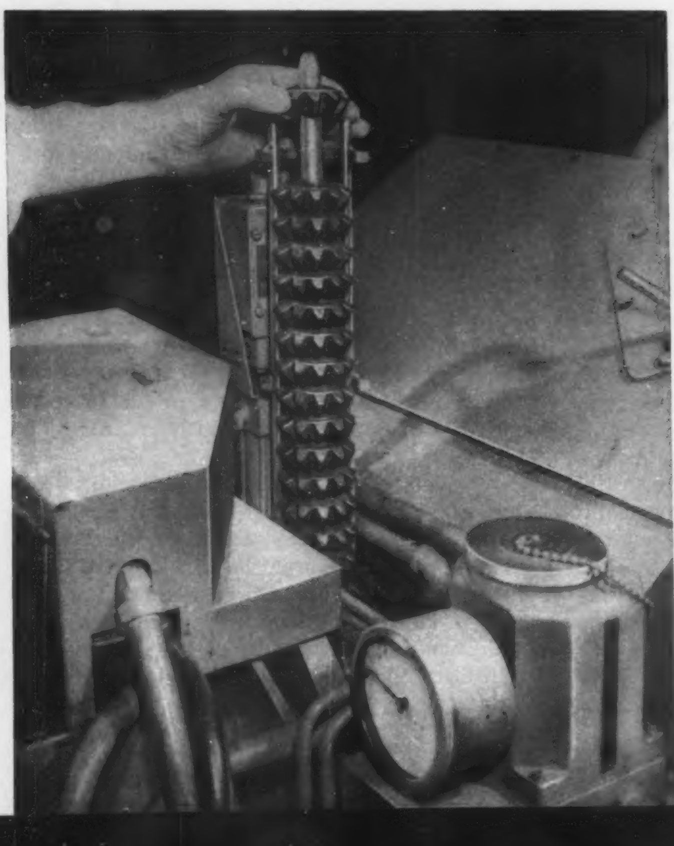


Fig. 4. In manually loading the automatic-cycling grinding machines seen in the heading illustration, the pinions are placed over a center post and between two guide pins.

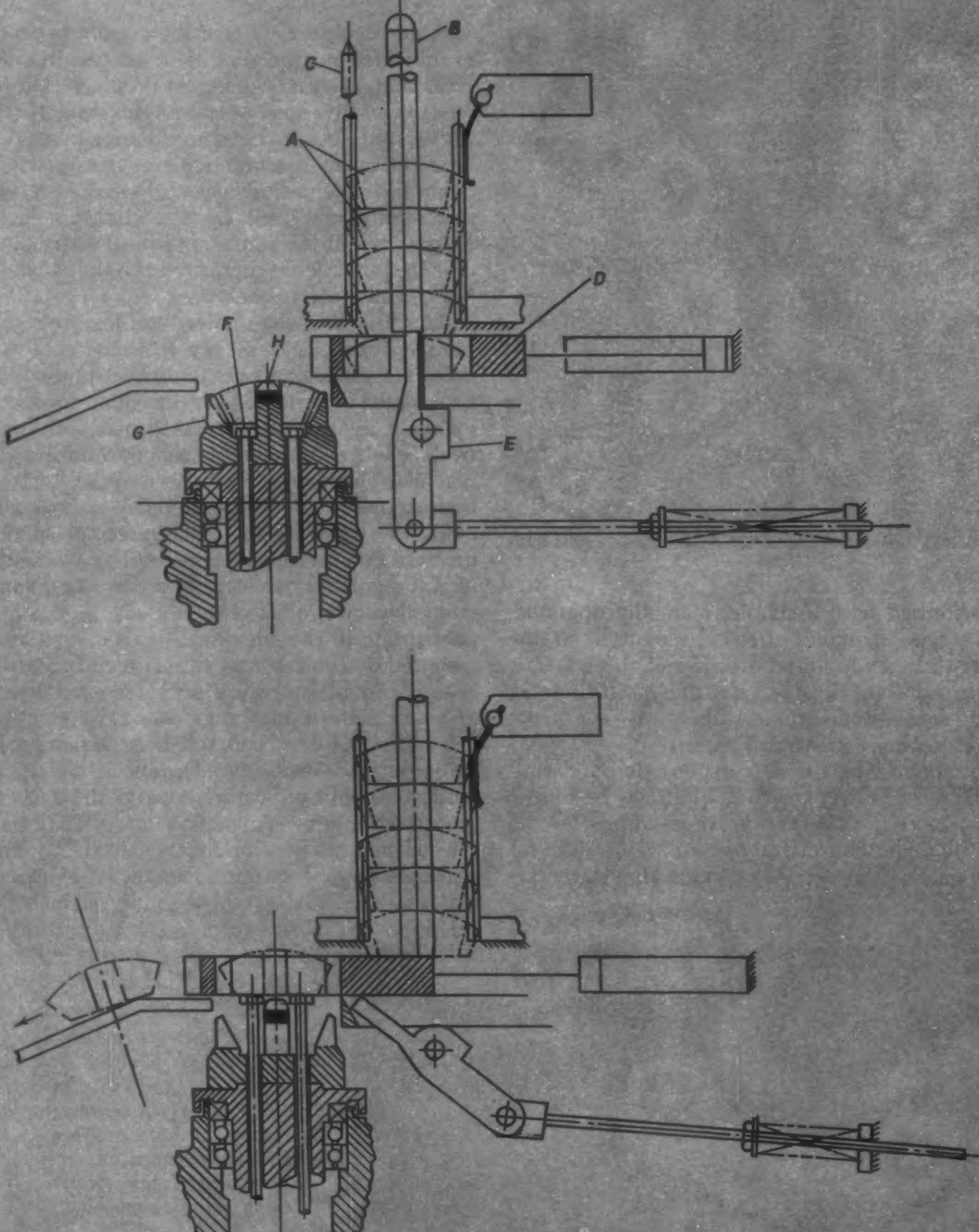


Fig. 5. Air-operated shuttle (D) transfers pinions from the magazine, one at a time. Ejector ring (F) lowers pinion into nest type chuck (G).

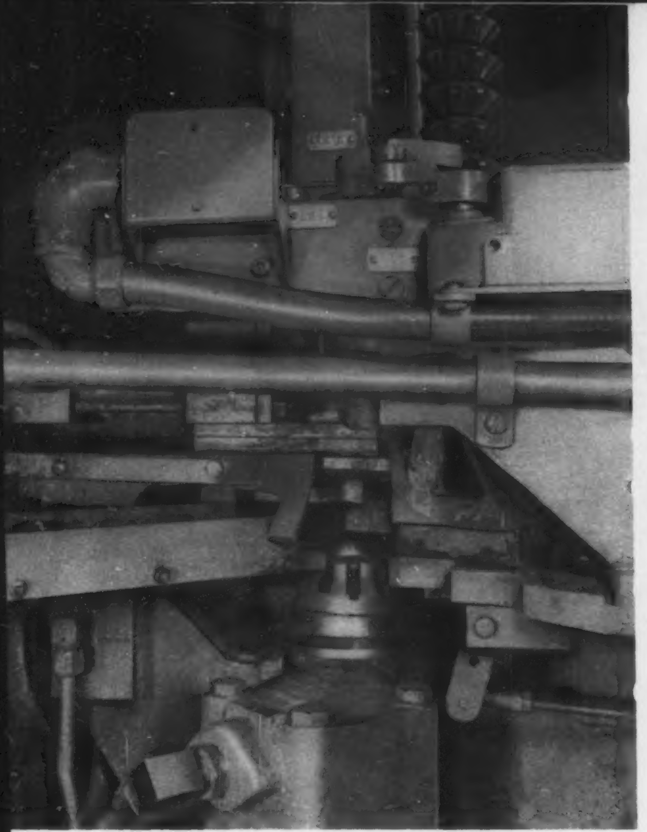


Fig. 6. Close-up view of grinding area on spherical-seat generating machine. An in-process air gage automatically controls work size and adjusts for wheel wear.

is performed with a simple, manually operated, swing type diamond dresser, mounted on the wheel-slide. Only initial dressing of the wheel is necessary, since it stays sharp by self-dressing during normal operation. A close-up view of the grinding area is shown in Fig. 6.

Automatic wheel-wear compensation and control of the work size are accomplished by means of a Sheffield remote-indicating, in-process air gage. A carbide-faced, lever type probe rides on the spherical seat of each pinion during the entire grinding cycle. Progress of the grinding operation is indicated on the dial of a Lectrolair unit. A micrometer switch element in the Lectrolair head is set to make contact at the desired point in the dial range, just under the high tolerance limit, where it feeds a correction impulse to the size control circuit to compensate for abrasive wear. The sensing unit itself, called a Plunjet, is located on the back of the stationary wheel guard, and is operated by a lever connected through a shaft to the carbide-faced probe.

As the wheel-slide is fed to the end of its plunge stroke, a limit switch actuates a time-delay relay which allows the wheel to dwell and true the work surface. Size-correction feed increments of approximately 0.0002 inch are then introduced by a ratchet mechanism until size is reached. The micrometer switch in the Lectrolair then actuates another time-delay relay, which holds the wheel in for a three-second sparkout dwell to end the machine cycle. The wheel-slide feed is regulated by means of a pressure-compensated, flow-control valve.

A print of the electrical circuit diagram is mounted on the control console of each Mattison grinder. Small lamps are provided on the print to indicate the cycle progress. By watching the lights, the operator can tell what functions are being performed at any time during the cycle—the last lamp lit indicating how far the cycle has progressed.

The main purpose of this so-called "Cyntrac" electrical control system is to facilitate mainte-

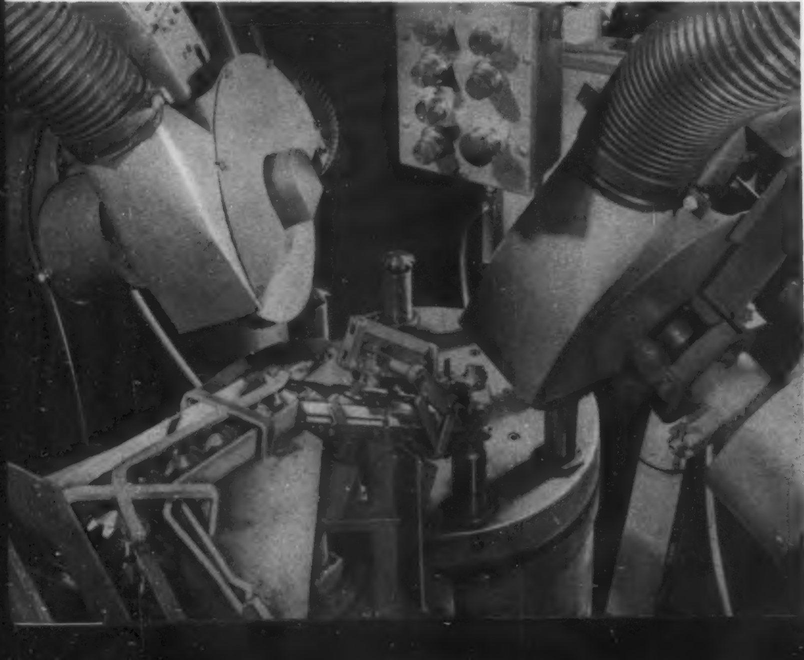


Fig. 7. Pinions on conveyor slide down a chute and are automatically loaded on vertical spindles of this rotary-indexing polishing machine.

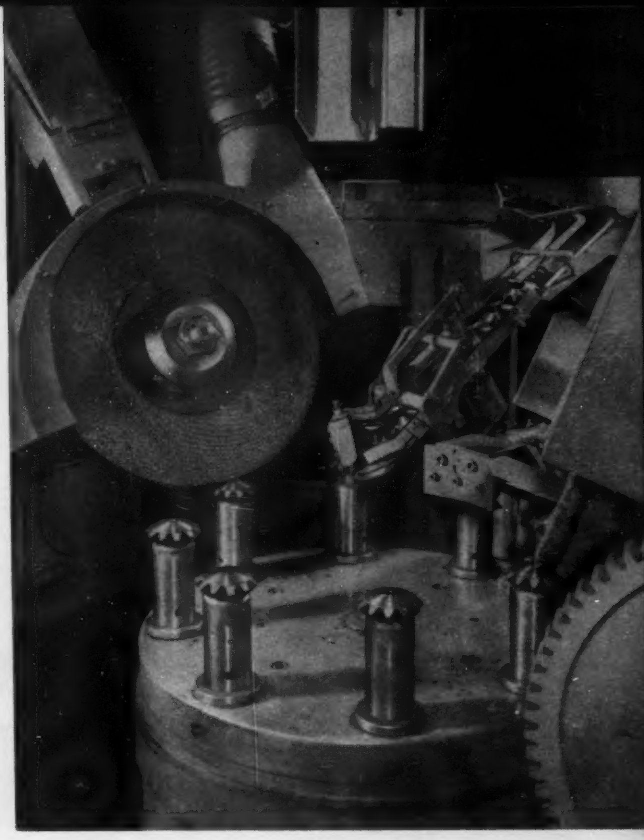


Fig. 8. When the pinions are indexed to positions below the buffing wheels they are rotated. Polished parts are automatically unloaded from the vertical spindles.

nance and trouble shooting. A stepping relay breaks the circuit up into small sections. Each step controls only one operation in sequence. That operation must be performed properly to satisfy limit switches or interlocks before the relay can step ahead to the next operation. Trouble can easily be pinpointed since the circuit section between the lamp that has last been illuminated and the next lamp contains the offending contact or limit switch.

A limit switch mounted along the wheel-slide is set to illuminate a "wheel worn" pilot light when the abrasive wheel has been used to its allowable limit (a reduction in diameter from 24 to 16 inches). Another limit switch prevents cycling of the machine when the supply of work-pieces needs replenishing (when the number of pinions in the magazine is less than five).

Coolant used for the spherical-seat grinding operation is water with soluble oil in solution. The coolant passes through a Barnesdril Kleenall filter. This is a tank type, two-stage, combination magnetic and fabric unit. The coolant passes over a magnetic drum to remove ferrous particles, and then through an automatically changing filtering fabric. The fabric removes nonferrous foreign material from the coolant.

Spherical seats on the differential pinions are finished on the Acme automatic polishing machine seen in Fig. 7, which is equipped for automatic loading and unloading. Work-pieces slide down a chute from a conveyor, are picked up one at a time by pivoting fingers, and are placed on one of the eight vertical spindles on the rotary indexing table. As the pinions are indexed beneath the two sisal buffs, Fig. 8, they are rotated by the spindles. The buffing wheels rotate at 6000 sfpm, and polishing compound is automatically applied to their peripheries. The indexing rate of the rotary table is infinitely variable for outputs up to 1000 per hour. While there is no measurable stock removal in this operation, grinding marks are removed and the specified surface finish of 15 micro-inches is obtained.

Bores of the differential pinions are finished on a Micromatic dual-spindle honing machine, Fig. 9. Work-pieces are automatically loaded into position below the honing spindles by means of a shuttle fixture. Two gears are completed at a time in a ten-second cycle. From 0.0005 to 0.0012 inch of stock is removed, and a surface finish of 15 micro-inches is produced. Also, maximum taper is held to 0.0002 inch throughout the length of the different pinion bores.

Fig. 9. Dual-spindle honing machine with shuttle fixture is used to finish the pinion bores to a surface finish of 15 micro-inches.

Economical Press Tooling

How would you go about tooling up for a "low"-production car at minimum cost, with the output to be integrated with the manufacturing facilities for high-production automobiles? Here is how Ford planned the Falcon for simplified design and made low-cost press tooling to stamp components

BASIC OBJECTIVES of the Ford Motor Co. in designing the Falcon were light weight, low initial cost, full size (six passengers), minimum maintenance cost, performance and top quality equivalent to the standard Ford, and high economy. These objectives were met by careful investigation, design simplification, and the development of many cost- and weight-saving ideas. The result was an economical, six-passenger car, having a six-cylinder, 90-hp, front-mounted engine, that is receiving wide acceptance. Over-all length of the Falcon is 181.1 inches; the height, 54.5 inches; the width, 70 inches; and the weight, 2366 pounds —40 per cent or 3/4 ton lighter than the Ford Fairlane.

Detailed planning started with the decision to build the Falcon in March, 1957. At that time, the engineering staff began to prepare idea sketches to determine the best approach for meet-

ing the objectives. These sketches were presented to the Ford Division and analyzed by management, financial officers, manufacturing engineers, and sales personnel. Some of the design considerations investigated through comprehensive market research and analysis, as well as detailed engineering studies, included the type of engine, its location, and size of the car.

Consultation with manufacturing engineering was held continually to determine the feasibility of economic manufacture. The recommended changes that would save time and cost without impairing the function or appearance of the car were incorporated immediately. Full-size clay models—a total of eighteen different renderings in the case of the Falcon—were then made and presented to the Product Planning Committee. This committee, consisting of sixteen top executives of the company, is responsible for approving the final styling and design features of all cars.

Master drafts of the Falcon body, accurate to 0.010 inch, were drawn with a gold stylus on white enameled aluminum. Paper was not used because it shrinks and expands with changing temperature and humidity. From these master body drafts, drawings were made, and three-dimensional body forms were built of laminated mahogany. These master-die patterns served as molds for casting steel production dies and to check out surfaces when the model is subsequently integrated and cubed.

After final approval, engineering began to fabricate hand-formed, prototype steel bodies of the Falcon. These prototypes were exhaustively tested at the Ford proving ground, as well as on highways throughout the country. Advance prints of detail parts and accessories were released to manufacturing and purchasing to plan production, order equipment and tooling, and determine suppliers. The part designs were not finalized until manufacturing had a chance to suggest changes and modifications that cut costs, saved weight, or permitted the use of new production techniques. Then, prints of the final designs were released for production or purchase. More than 200,000 drawings were needed to carry all necessary information to manufacturing and assembly plants. Close cooperation between engineering and manufacturing was a primary factor in the success of the program.

Design Features of the Falcon

The most outstanding feature of the Falcon is undoubtedly simplicity of design. Early in the program, it was decided to use a unitized body, Fig. 1, in which the body itself provides the needed strength and rigidity, and no frame is required. This type construction reduces weight to a minimum, and provides torsional and rigidity benefits. Also, the unitized, integral body-frame design permitted attaining one of the primary

for the Ford Falcon

CHARLES H. WICK
Managing Editor

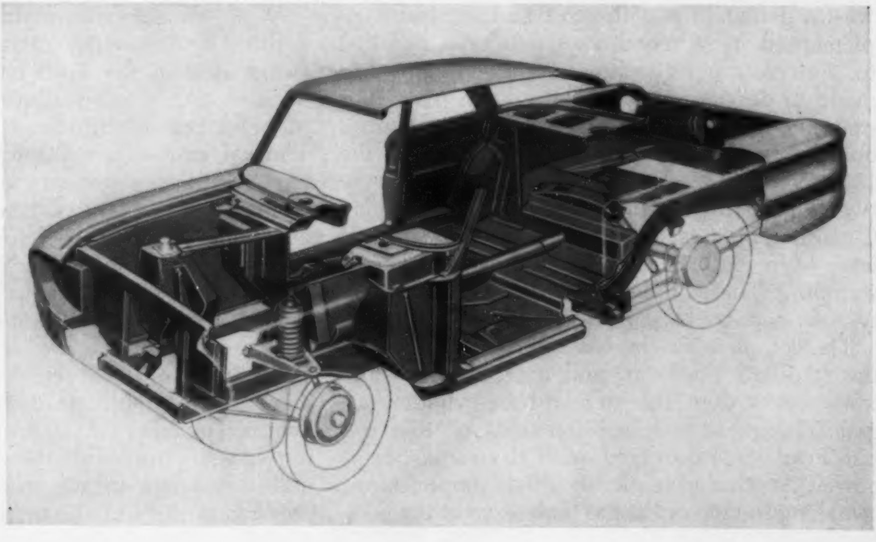


Fig. 1. Unitized body construction of the Ford Falcon reduces the over-all weight while providing the necessary strength and rigidity.

Fig. 2. Press for drawing Falcon front-fender apron and radiator supports is manually loaded and unloaded because of the lower production that is required.

objectives: minimum exterior size with interior passenger compartments comparable to existing cars. To overcome the problem of rust in the unitized construction, Ford used a zinc-plated steel that not only resists rust but takes a high-quality weld. This specially processed, galvanized steel is used in rocker panels and other body sections particularly susceptible to exposure, and permits weight reduction.

Major weight reduction, however, resulted not so much from the exterior dimensions, but because all components of the car were designed with reduced weight in mind. Actually, a "weight budget" was set up for each component, which was as demanding as the cost budget, and complemented it. When three parts were required to perform a specific function, an attempt was made to do the job with one or two parts. For example, the door frame for the Falcon requires only two parts instead of the twelve used in the 1959 Ford. Also, the Falcon door requires only twelve parts instead of the standard twenty-one. Garnish moldings and lower kick-pad surfaces have been made a part of the inner-panel door stamping. The complete door assembly has thirty-one fewer parts than the conventional design.

The complete Falcon has 200 fewer parts than the standard Ford car, and its engine has 120 fewer parts than the standard six-cylinder engine. The engine weighs 190 pounds less than the last Ford engine offered with the same horsepower. Another example of design simplification is making the top of the gas tank serve as the floor of the luggage compartment, which saves 6 pounds per car. The suspension springs and shock absorbers are mounted from the upper arms to towers in the sheet metal of the Falcon bodies for improved stability.

The design of the Falcon was an engineering solution to the economic problem of cost inflation. Experience gained in over forty years of designing economy type vehicles for Ford of England, Germany, and France was used. Also, the recent design of a new military vehicle—the Mutt—to replace the war-time Jeep provided techniques that could be applied to the mechanical components of a passenger car.

While considerable savings could have been realized by employing standardized parts already being used in the Ford family of cars, it was decided to create an all-new car with no parts interchangeable with those of standard models. This, of course, necessitated new tooling, new equipment, engineering, and some rearrangement of production facilities. About 13,000 parts go into the making of each Falcon. The magnitude of the job was tremendous. Starting from scratch, all of the different parts had to be designed, approved, tested, studied as to their feasibility for manufacture, produced, checked, and assembled. Tight timing of the accelerated program required meeting inexorable deadlines for hundreds of details. The fact that the program was completed in two years instead of the decade ordinarily required is a fine tribute to the engineering and production skills of the men involved.

Integrating Production at Minimum Cost

Another major obstacle was the stipulation that tooling up for the "low"-production Falcon had to be done at minimum cost, with the output to be integrated with the existing manufacturing facilities for high-production cars. In other words, no new facilities, and a minimum of expenditures for capital equipment. Estimates made early in the planning program indicated that requirements for the Falcon would be about one-third those for standard Ford cars. Yet, plans had to be made to produce parts on existing equipment, and build the unitized Falcons on the same assembly lines as frame-and-body Ford cars.

An outstanding example of savings was in the design of low-cost dies for the production of sheet-metal parts used on the Falcon. For example, blanks for the Falcon front-fender apron and radiator support member are produced on a standard squaring shear. The blanks are transported by truck to a storage area, and then to the pressroom as required. Comparable parts for the high-volume Ford cars are blanked on punch presses equipped with more expensive cutoff dies that have double wear-plates and air-operated ejectors. The presses are provided with automatic decoiling, straightening, and feeding equipment, as well as automatic blank stackers. Two blanks are produced per press stroke, one being gravity-shed to the side and the other to the front.

Drawing of the Falcon front-fender apron and radiator supports is performed on the press shown in Fig. 2. Differences in the dies for the Ford and Falcon counterparts are illustrated in Fig. 3. The high-volume Ford die seen at the left is equipped with double wear-plates, air-operated disappearing gages, and an air-operated lifter; while the Falcon die (right) has single wear-plates, solid front and rear gages and side guides, and spring lifters. Riser-blocks are used with the Falcon die to further reduce costs.

Press operators manually load and unload the Falcon die, with the spring lifters acting as blank supports during loading and elevating the drawn parts to facilitate unloading. After unloading, the parts are manually turned over and placed on a belt conveyor leading to the trim press.

For Ford production, an adjustable stock-lift is provided in front of the draw press, and the blanks are automatically loaded into the die. An automatic, air-operated blank support prevents interference in loading. Drawn parts are automatically unloaded, turned over, and dropped on a chain-operated transfer unit by means of an "iron-hand" type extractor.

Trimming of the Falcon front-fender apron and radiator supports is done on the press shown in Fig. 4. Again, the die is manually loaded and unloaded by the press operators. Also, the scrap produced must be removed manually. Air-operated lifter-pins are provided to support the drawn

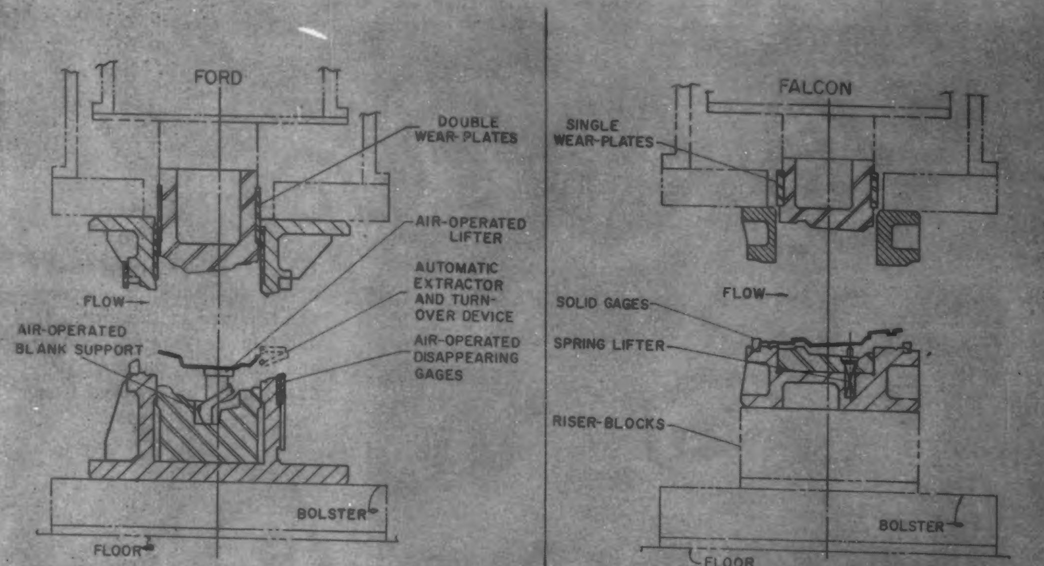


Fig. 3. Schematic representation of differences between Ford and Falcon dies to reduce costs.

parts during loading and eject the trimmed pieces. On the other hand, the die for Ford parts is automatically loaded and unloaded, and the scrap generated is gravity-shed into holes in the floor and conveyed to an automatic baler.

In flanging and restriking the Falcon parts, (heading illustration), loading and unloading are done manually. A comparison between the Ford and Falcon dies for this operation is presented in Fig. 5. As with the preceding Falcon dies, single wear-plates, spring lifters, and riser-blocks are employed to reduce costs. The die for higher volume Ford production has double wear-plates and air-operated lifters. Parts are automatically placed in this die by means of an air-operated, combination transfer and loader unit. However, they are manually unloaded and placed on an air-operated, parallelogram type, combination loading and unloading unit for the next operation—piercing. For piercing Falcon parts, the die is manually loaded and unloaded.

In general, all Falcon dies are of welded steel-plate construction, with iron castings used only where necessary. All guiding surfaces consist of single, hardened tool-steel wear-plates bearing on cast iron. Only a limited effort is made to provide for the quick replacement of special tool-steel inserts. Die shut heights are held to a minimum, and standard riser-blocks and steel plates are used to fit the dies to the presses, thus eliminating the need for designing and constructing special iron castings. Since Falcon production requirements take only about 30 per cent of the available press time, the remainder is used for the various stampings required in the many other Ford products. The absence of automation reduces the time required for removal and installation of the Falcon dies.

In contrast, the dies for high-volume Ford production are designed and constructed with every possible consideration for reducing maintenance, promoting interchangeability, and meeting production schedules. Full advantage is taken of the latest automation techniques to increase production. The dies are made from special iron and semi-steel castings. All guiding surfaces, such as die-heels and cam-slides, consist of hardened tool-steel, double wear-plates. Special tool-steel inserts are provided in all areas of the dies that are subject to excessive wear or fatigue. Skilled diemakers and maintenance employes conduct scheduled inspections of the dies and automation equipment to insure uninterrupted production of quality parts.

Every Falcon part was carefully evaluated to determine the feasibility of using automation in its production. The decision as to whether to automate or not depended primarily on economic considerations. In most cases, the use of automation equipment was not justified for the low-volume production requirements.

Similar studies were made for all assembly operations. Again depending on economic considerations such as the availability of suitable equipment, manpower requirements, and the adaptability of automation equipment to quick

Fig. 4. Falcon front-fender apron and radiator supports are trimmed in this press. In addition to manual loading and unloading, the scrap produced must be removed from the die by hand.

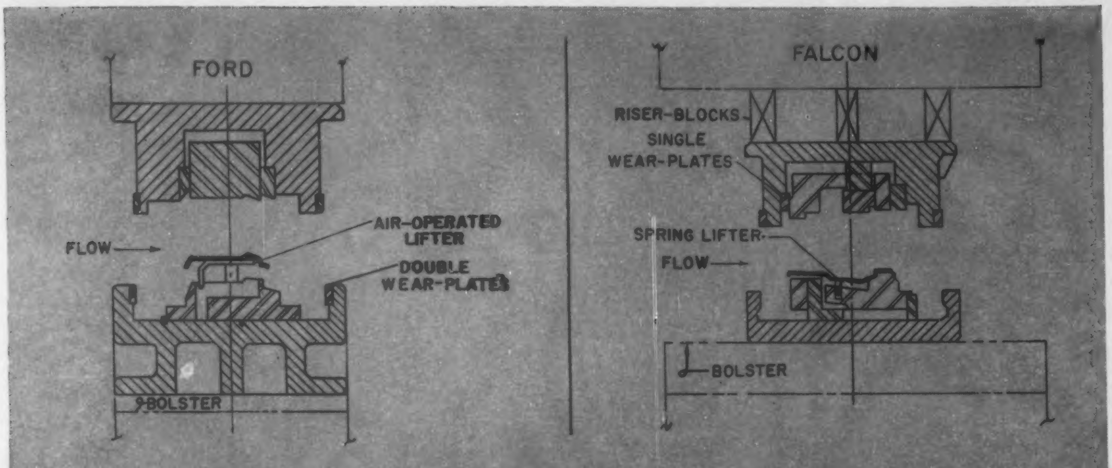


Fig. 5. Comparison between Ford and Falcon dies used for flanging and restriking. The Ford die is automatically loaded, but manually unloaded.

change-overs (for handling other parts), it was found that portable gun welding was generally preferable to machine welding. One exception to this is the line for Falcon apron and side-member assembly, Fig. 6.

This line consists essentially of a battery of nine Ford standard, C-frame welding presses, such as the one seen in Fig. 7, made by the Goodrich Welding Equipment Corporation. These spot-welding machines each have their own air and hydraulic systems, and individual control panels. Certain of the machines are connected with automation devices for automatically unloading, transferring, and loading the assemblies.

In the first operation, gussets are joined to front-suspension, lower-arm adapters by means of eight spot welds, 0.075- to 0.075-inch stock thicknesses. Next, spring-housings are spot-welded to inner front side-members at six positions. These two sub-assemblies are joined in the third operation with eight spot welds. Added to these in subsequent operations, with seventy-seven spot welds, are the front and rear aprons for the front fenders. On the machine seen in Fig. 7,

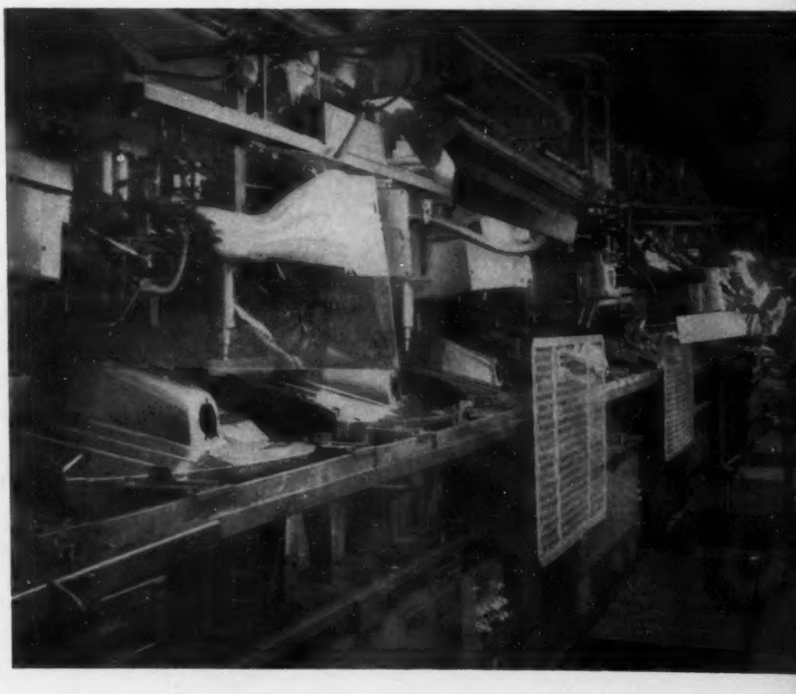


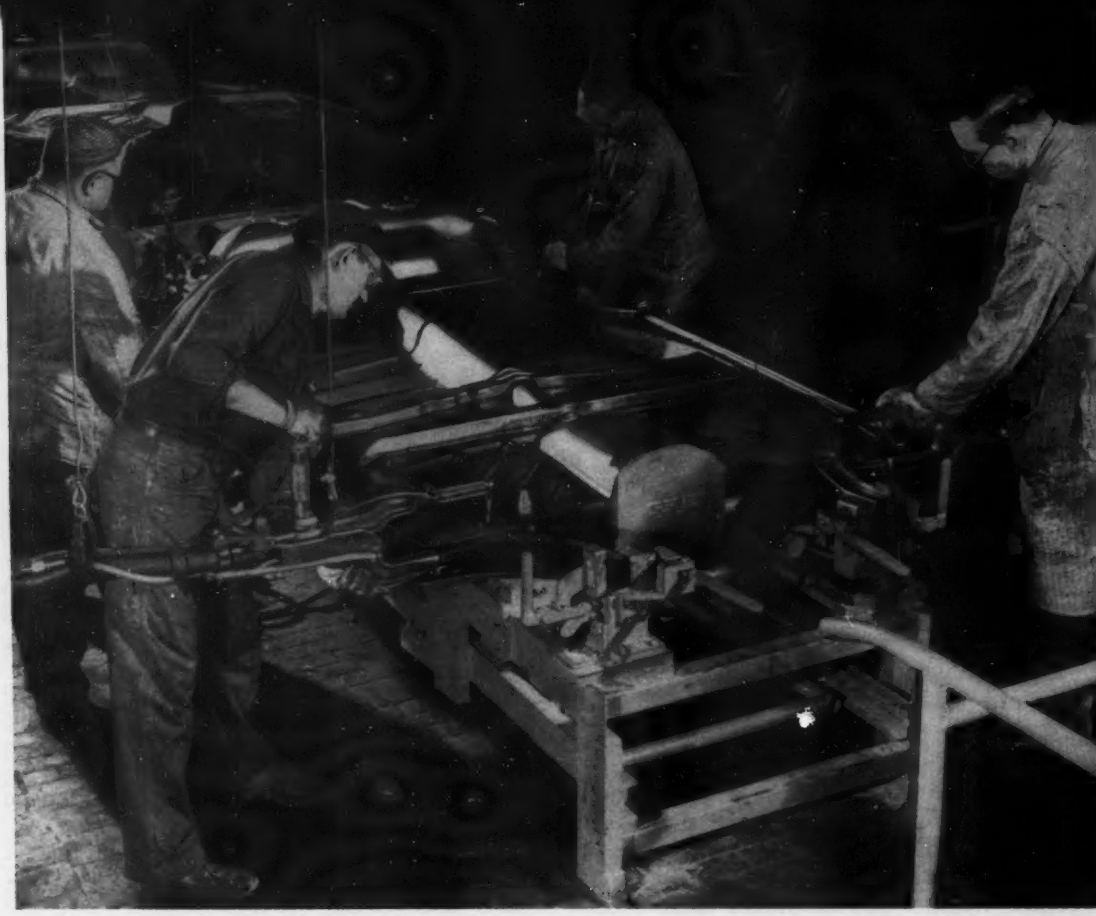
Fig. 6. Over-all view of assembly line for Falcon apron and side-member assemblies. Portable spot welders are used for most Falcon assembly operations, instead of the press welders shown.

Fig. 7. Close-up view of one of the Ford standard, C-frame welding presses, which have their own air and hydraulic systems.

most of the spot welds are made at the first station. When the part has been automatically shuttled to the second station, the remaining spot welds are made. The parts are carried on slide-rails and the automatic shuttle bars. In the last operation on this line, a total of ten holes, varying from 11/32 to 17/32 inch in diameter, are drilled and deburred, and two of the holes are reamed, with the machine shown in Fig. 8. Six of the holes are at an angle, two are vertical, and two horizontal. This machine also has two stations, with the deburring station at the left (not shown). The apron and side-member assembly is automatically located and clamped in the fixture before the drilling operation can begin.

Because of the limited requirements for Falcon parts, this line was designed to permit quick change-over from left- to right-hand apron and side-member assemblies. In this change-over, which is usually accomplished during the third shift, all of the fixtures are changed on the press type welding machines, and the entire drilling, deburring, and reaming machine is replaced. A spare drilling machine, kept adjacent to the production line, is moved into place when the other one is removed.

Fig. 8. Machine used to drill and deburr ten holes, and ream two of the holes, in each Falcon apron and side-member assembly.



Building Unitized Bodies at American Motors

Single-unit body construction is an outstanding feature of the Rambler compact cars. Here are details on how major sub-assemblies are resistance welded on "merry-go-round" fixtures, and the unitized bodies are phosphatized and prime-coated. Priming is accomplished by completely submerging the bodies in a unique deep-dip system

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UNITIZED CONSTRUCTION—in which the frame is built right into the underbody of the car—is no innovation at American Motors. Nash-Kelvinator Corporation, formed by the merger of the Nash Motors Co. and the Kelvinator Corporation in 1937, had experience with this type of construction on its prewar automobiles. Also, the Hudson Motor Car Co., which merged with Nash-Kelvinator Corporation in 1954 to form American Motors, used similar methods of building bodies.

However, techniques of single-unit body construction have been continually improved. The type of unitized body employed on the current Rambler compact cars is illustrated in Fig. 1. Since there is no separate frame, as in conventional body-and-frame construction, there is a considerable saving in over-all weight. Also, unitized construction provides the additional ad-

Fig. 1. Single-unit body construction of the type used on Rambler compact cars saves weight and increases strength and rigidity.

vantages of rigidity, strength, and safety as a result of the passenger compartment's being surrounded on all sides by a one-piece, three-dimensional structural unit.

Major sub-assemblies for the Rambler bodies are built up by welding components together on "merry-go-rounds" containing from eight to twelve work-holding fixtures. For example, the so-called "uniside" sub-assemblies are produced on two merry-go-rounds, one for station-wagon bodies and the other for sedans. The one for station wagons, Fig. 2, is equipped with four pairs of fixtures (four for left-hand and four for right-hand unisides), while the sedan line has five pairs of fixtures.

Uniside sub-assemblies are made up of rear-wheel housings, roof rails, door-hinge pillars, sills, and other components. The parts are manually loaded into the fixtures, and secured by means of quick-acting clamps. Twenty welders are located at various stations around each merry-go-round, and make a total of about 750 spot welds in joining the components of each uniside sub-assembly. The speed at which the fixtures are moved along the tracks of the merry-go-rounds can be varied for outputs of from ten to fifty cars per hour (twenty to one hundred sub-assemblies per hour).

The portable resistance-welding guns used on these and other assembly lines are controlled by Weltronic electrical timers (having voltage control regulators) to make an average of 140 spot welds per minute. About 50 per cent of the guns are hydraulically operated, and the other half are actuated by air. The guns, made by Progressive and Martin, are equipped with electrode tips either 3/16 or 1/4 inch in diameter. Most of the spot welds are made with the larger tips, but the smaller tips must be used for certain locations where a large number of welds must be made in a limited area. The tips are changed on an average of once a day, with some having to be replaced two or three times a day and others lasting several days. More than 9000 welds are made on each car.

Underbody sub-assemblies are built up in a straight-line operation rather than a merry-go-round arrangement. At one location along the line, seen in the heading illustration, the front and rear floor pans are joined to the side-sill sub-assemblies. An air-operated fixture lowers the floor pans onto the sills, and four operators perform the required welding. At a subsequent location along the line, the sub-assemblies are turned over and various reinforcements are arc- and spot-welded to the undersides of the bodies. When the components reach the end of the line, they are washed.

On the underbody framing merry-go-round, Fig. 3, the front-suspension unit is added to the underbody sub-assembly. Then, the sub-assemblies of the inner wheel housing, dash and toeboard, outer wheel housing, and lower rear-deck panel are added by means of spot- and arc-welding operations. This merry-go-round is equipped with twelve work-holding fixtures.

Unlike the uniside sub-assembly, which requires two merry-go-rounds to produce various model Ramblers, the underbody framing and all other merry-go-rounds handle two- and four-door sedan, hardtop, and station-wagon bodies. This is accomplished by providing the fixtures with additional quick-acting clamps.

The main framing-line merry-go-round, Fig. 4, is also equipped with twelve fixtures having sufficient quick-acting clamps to accommodate various style bodies. Here, the sub-assemblies of the underbody, front-end, unisides, roof, and cowl

are joined by spot and arc welding. The work-holding fixtures are particularly critical on this line, since they control the fit of the doors and other components. A separate roof-setting fixture, Fig. 5, is employed for sedan bodies only. This fixture is loaded with the roof panel and then lowered onto the four corner posts of the main framing fixture. Accurate positioning of the roof panel in this way facilitates subsequent assembly of the windshield and back light.

From the main framing line, the bodies are transferred to trucks which are automatically conveyed along a straight panel line containing eighty-seven stations. On this line, the fenders, doors, instrument panel, and other components are added. Rear fenders are welded to the unitized bodies, while the front fenders are bolted to the assemblies. Metal-finishing operations are also performed along this line.

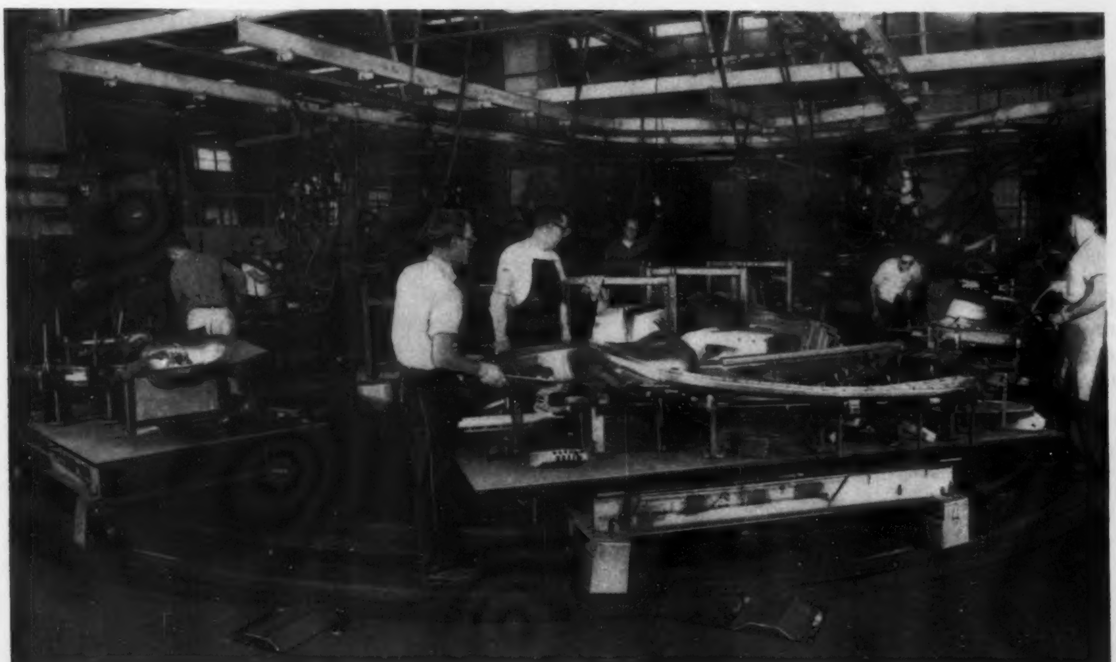
Centralized production scheduling is controlled by means of IBM machines. Requirements are broadcast to the various departments and assembly lines to control the flow of parts. In addition to final inspection of the unitized bodies, floating inspectors are provided on each merry-go-round and along every straight assembly line.

Completely welded, unitized bodies are suspended from an overhead monorail, chain type conveyor for phosphatizing, priming, and painting. Phosphatizing involves chemical conversion of the metal surfaces to a nonmetallic coating composed of microscopic crystals that are integral with the metal. This treatment provides a durable base for the paint, improves paint adherence, and minimizes corrosion of the underlying metal.

The continuous, automatic phosphatizing line consists of prewashing, cleaning, rinsing, phosphate coating, rinsing, and sealing the bodies. The various solutions are applied to all portions of the bodies by a multiplicity of spray nozzles suitably arranged along the continuous line. Prewashing, performed by spraying the bodies with an emulsion type cleaner in water at a temperature of 150 degrees F., has been added to the processing to remove excessive amounts of grease, dirt, solvents, and metal particles.

Cleaning is done by spraying the bodies with a water emulsion, containing 1/4 ounce of cleaner per gallon of water, at a temperature of 140 degrees F. Spray pressure is 30 psi. After rinsing with hot water (118 degrees F.) at a spray pressure of 25 psi, the bodies are phosphate-coated, as seen in Fig. 6. The phosphatizing solution is made up by adding 250 pounds of Pennsalt Fosbond No. 10, 12.4 pounds of caustic soda, and 1.3 gallons of accelerator to a recirculating tank containing 1770 gallons of water maintained at a

Fig. 2. Merry-go-round used for welding "uniside" sub-assemblies, which consist of rear-wheel housings, roof rails, door-hinge pillars, and sills.



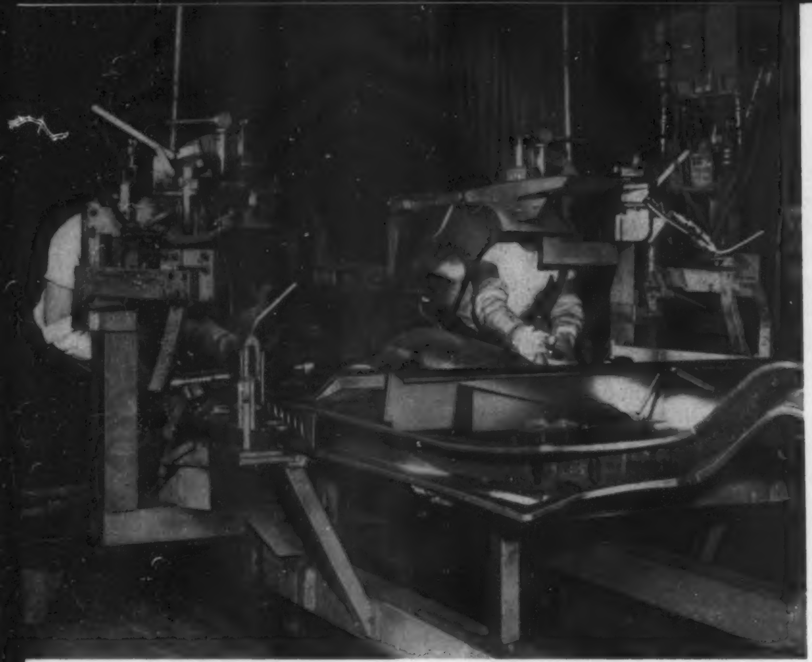


Fig. 3. Front-suspension components are added to the underbody sub-assemblies on this merry-go-round which has twelve fixtures.

temperature of 114 degrees F. Also, about 60 pounds of Fosbond No. 10 is added per day to maintain the solution at the required concentration. The solution is pumped from the tank to the spray nozzles at a pressure of 15 psi. This treatment produces a phosphate coating having a minimum weight of 185 milligrams per square foot. The average weight, which is checked twice a week, is 235 milligrams per square foot.

After rinsing the bodies with sprays of cold water, the phosphate coating is sealed by spraying with a chromic-phosphoric acid (Fosrinse) solution. The sealer solution is maintained at a temperature of 152 degrees F., and applied at a pressure of 20 psi. Make-up of the solution contains 3 pints (4.6 pounds) of Fosrinse in 1480 gallons of water. The solution is discarded and freshly remade each week. Following sealing, the bodies are dried by passing them through a gas-fired oven.

Rusting of automobile bodies has become an increasingly aggravating problem, caused by the growing application of salts to melt snow and ice on highways. Studies at American Motors showed

Fig. 4. Work-holding fixtures on this main framing-line merry-go-round have sufficient quick-acting clamps to accommodate various style bodies.

Fig. 5. Roof-setting fixture for sedan bodies is loaded with a roof panel and lowered onto the four corner posts of the main framing fixture.

that rust accumulation was most prevalent in recesses of automobile bodies such as sill members, rocker panels, and other cavities. The best solution was to properly apply paint in such recesses. It was originally thought that only the lower portion of the body, which was most affected by road salts, would have to be dipped in paint. However, in studying different methods of dipping the body, it was found that the equipment needed would be very little different if the entire body was dipped.

An experimental dip tank, 8 feet wide by 20 feet long and 7 feet deep, was first built and filled with sufficient specially formulated primer paint to completely submerge a body. A tram rail and two hoists were provided over the tank to simulate conveyor applications in controlling body dipping. By varying the viscosity and temperature of the paint, and the ventilation of the tank, it was found that the process could be used successfully in production.

While dipping of the entire body does have the disadvantages of more cost for the additional primer required and the need for controlling dirt

Fig. 6. Phosphate coating of the welded unitized bodies is accomplished by spraying with a solution maintained at a temperature of 114 degrees F.

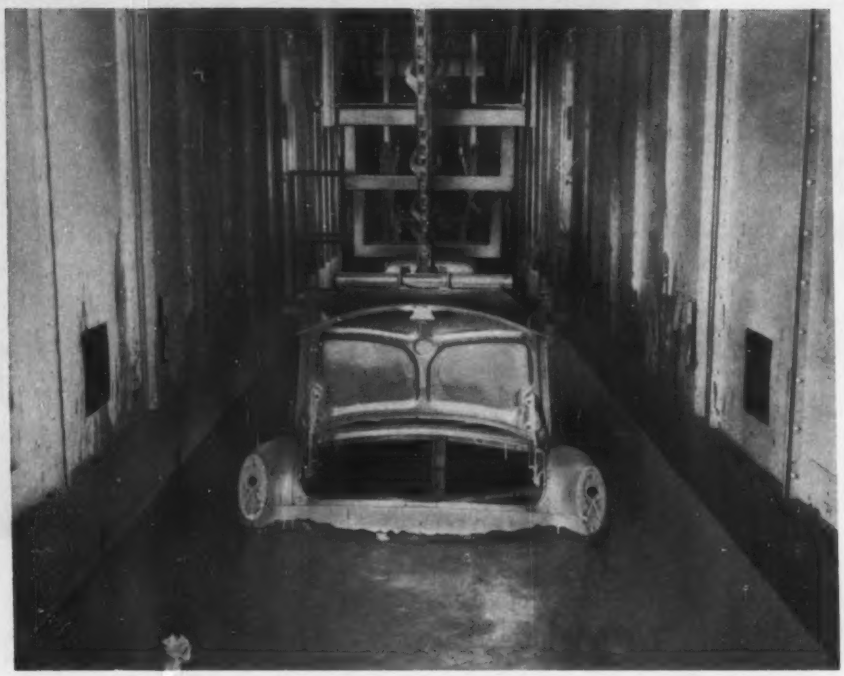


Fig. 7. (Left) In this deep-dip, primer-paint tank, the bodies are completely submerged to insure the paint reaching all recesses.

Fig. 8. (Below) Schematic view of the paint dip tank, which is 8 feet wide by 7 feet deep by 49 feet 6 inches long, and holds 12,000 gallons of primer.

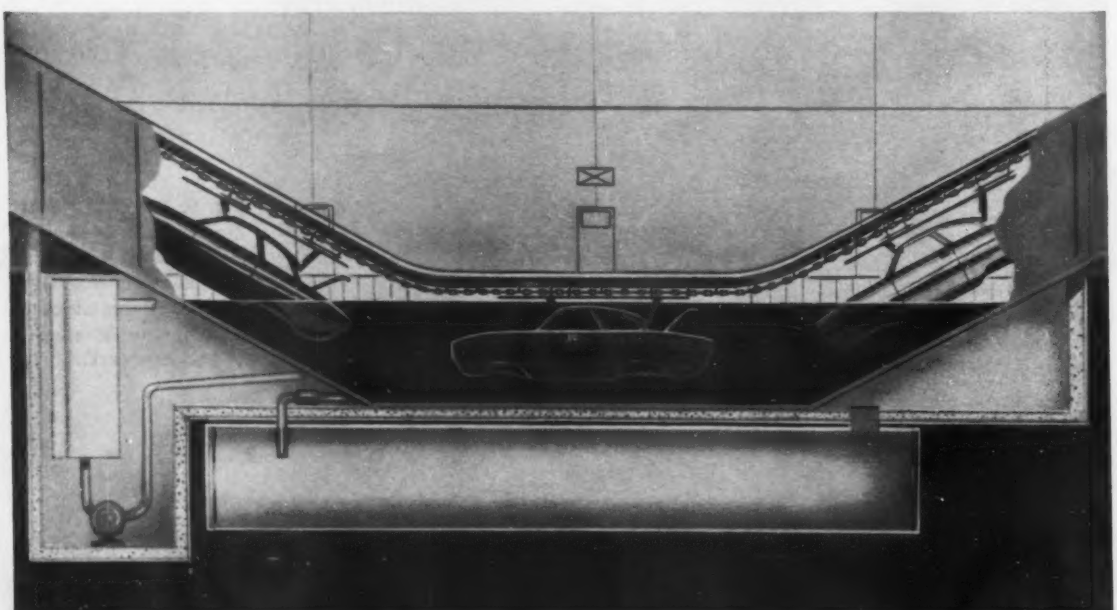
in the dip tank, the process has the following positive advantages:

1. More adequate corrosion protection in *all* of the inaccessible areas of the body, which is not possible with spraying or partial immersion.

2. Thorough sealing of all the welded seams—thus eliminating the separate sealing operations previously required.

Anticipated problems of having sags and runs of the paint and nonuniform paint thickness on various parts of the bodies were not as serious as had been believed. As a result, production equipment built by the Binks Mfg. Co. was installed. It is unique in the automotive industry of this country.

Immediately following phosphatizing and drying, the bodies are carried on an overhead con-



veyor to the paint dip tank, Fig. 7, which is sunk into the floor. The entire cooling, dipping, dripping, and drying operations are contained in a continuous tunnel extending from the dry-off oven through the primer-paint oven. The deep-dip tank, shown schematically in Fig. 8, measures 8 feet wide by 7 feet deep by 49 feet 6 inches long, and contains approximately 12,000 gallons of primer paint. A pump having a capacity of 750 gallons per minute is provided to permit complete circulation of the paint at least three times per hour. Each body remains in the paint during a travel of 35 feet.

Paint is introduced at various locations in the bottom of the tank, and drained off by means of overflow holes provided at the desired paint level in the sides of the tank. Dirt floating on the surface is removed with the overflow and filtered in the paint-circulation system. The dirt that settles to the bottom of the tank is removed by periodic cleaning. Filtration in the paint-circulation system consists of a screen having 1/4-inch-square openings, a Cuno filter that removes particles down to 0.008 inch in diameter, and a cartridge type filtration unit capable of removing particles of 15 microns.

Heat exchangers are provided in the overflow section of the circulating system to maintain the paint at a temperature between 80 and 100 degrees F. During production, the paint is warmed by the bodies entering the tank and the heat generated by the circulating pumps, and cooling water is passed through the heat exchangers. However, during nonproductive shifts and over week ends and vacations, the paint cools. In such instances hot water is fed to the exchangers before resuming production.

An inclined drip-tunnel section of the system, Fig. 9, is arranged so that excess paint dripping from the bodies flows back to the dip tank. Cleaning of the drip tunnel at periodic intervals is facilitated by a removable apron supporting a plastic film that is impervious to paint. Approximately 1 1/2 gallons of paint are used per body, and the conveyor speed can be varied to paint up to fifty bodies per hour. Air is exhausted at regular intervals along the tunnels, and clean, filtered air, at a temperature of 85 degrees F., is supplied to the system.

A dump tank of 18,000 gallons capacity has been provided immediately below the dip tank. The tanks are connected by three automatic, quick-opening, 8-inch valves, so that the paint can be drained in from three to four minutes in case of fire in the dip tank. Also the dip and drip tunnels are protected by a Cardox system and an automatic sprinkler system to extinguish fires. All exhaust and supply fans, as well as the conveyor, are automatically stopped when the Cardox system is actuated. Also, the dump valves are automatically opened to empty the dip tank. An automatic "sniffer" makes a graphic record of vapor concentrations and sounds an alarm when the allowable limit is exceeded.

Fig. 9. As the primed bodies are conveyed up this inclined tunnel section, excess paint dripping from the bodies flows back into the dip tank.

Paint sags and runs are controlled by the proper paint formulations—a ferrochrome type dip primer to which solvent is added to maintain a viscosity of fourteen seconds SSU, adjustment of the equipment, and the use of snorkels (air-removal devices) and other devices. One unexpected problem encountered was the difficulty in sinking the bodies into the paint in the time allotted by the conveyor speed. Wheel housings, fenders, and other components, as well as the body itself, acted as floats. This was overcome by proper design of the overhead carrier and by the provision of holes to admit paint and vent entrapped air.

At the end of the drip tunnel, an automatic wet-transfer device is provided to transfer the bodies from the overhead conveyor to floor type conveyors. Then, the bodies pass through spray booths for finish-painting.

Trucks Shift to Automatic Transmissions

Indiana's biggest metalworking plant is making the job of the truck driver an easier one

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AUTOMATIC TRANSMISSIONS for medium- and heavy-duty trucks show promise of making the shift "stick"as obsolete as the solid rubber tire. Built by the Allison Division of General Motors, the new transmissions are designed for on-highway and off-highway trucks in the 200-hp-gasoline-engine class. Currently, the units are available as optional equipment in Chevrolet, Ford, Dodge, Reo, Diamond-T, and GMC truck models. Described here are a few of the many unusually interesting operations involved in the manufacture of the transmissions.

One of them concerns broaching the teeth in a large ring gear. This gear is made of 4140 seamless tubing. The outside diameter measures 7 3/4 inches, and the wall thickness is 7/16 inch. Fifty-nine 10-pitch involute teeth with a 25-degree pressure angle are required.

After the tubing goes through its initial boring, turning, and cutting-off steps, the ring-gear blanks are brought by a monorail conveyor to the broaching equipment seen in Fig. 1. This is a Lapointe 50-ton dual-ram pull-up machine. A roughing broach and a finishing broach operate together. Each of these broaches is a huge tool, measuring 6 feet long and weighing approximately 800 pounds.

The work is placed on the pilots of the two broaches. When the broaches are pulled up, the blanks are thrust against horns on the bottom of the platen. Coolant rings enclose both horns. Once the broaches pass through, rubber-covered hooks hold the work. The involute form produced is critical, since the rings mesh with the planetary pinions of the transmission.

Even though the broaches are flooded with cutting oil during the operation, the relatively high rate and large amount of stock removal builds up considerable heat in the work. To control size, rough-broached ring gears are either submerged in the coolant tank seen on the operator's left, or recirculated on the conveyor, and thus allowed to reach room temperature. Meanwhile, the operator takes a previously rough-broached ring gear which has had time to cool, and finish-broaches it simultaneously with the rough broaching of a new blank.

Hollow Head Contains Sixteen Broaches

Another unusual broaching job involves one of the main clutches of the transmission, called an apply plate. This work-piece is a circular stamping of mild steel, and is manufactured in two sizes—7 and 10 1/2 inches in diameter. Around its circumference is a series of eight ears. The operation consists of broaching the two sides of all eight ears simultaneously.

The equipment, illustrated in Fig. 2, is a Cincinnati 10-ton vertical duplex surface-broaching machine which was adapted with a bolster. Both plate sizes are processed together, one at each of

the two stations. Since the rams operate in alternate directions, production is continuous. At each station there are sixteen broaches (eight left hand and eight right hand) grouped around a large hollow head, 15 inches high. The apply plate sits on a pedestal and is located by a fork on the head. The tools descend as a unit, removing about 0.030 inch of stock each.

The transmission case is a box-shaped gray-iron casting, approximately 17 inches long, 12 inches wide, and 12 inches high. To protect the hydraulic system of the unit, all foundry scale and dirt is eliminated by running the rough castings through a Kolene chemical cleaning line. An advantage in cleaning the castings before any surfaces are machined is that it can be done rapidly, since no particular care need be exercised in handling the work.

Oil-Pan Surface is Ground in Rough Casting

Before entering transfer lines for drilling, reaming, and tapping, the case goes through a series of qualifying operations. In the first of these, the bottom of the case (the pan surface) is ground and two construction holes are core-drilled and bored. A three-station Mercury rotary indexing machine is used. One station is for the loading and unloading, one for the grinding, and one for the drilling and boring. The view in Fig. 3 shows a tool change-over being made at the drilling and boring station.

Three hollow fixtures, each able to revolve under power on its own axis, are spaced around the circular table of the machine. The castings are nested in the fixtures, resting on their flanges. Hydraulically operated clamps centralize and grip the large core surface at each end of the case. Grinding is done directly into the rough-cast surface. Stock removal averages 3/16 inch in depth, and flatness is held within 0.002 inch. Once a fixture has been indexed to the grinding station, the wheel head moves down and the fixture starts to spin. The wheel is of four-segment design, and has a 4-inch face. A wheel dresser is mounted on the table between each of the fixtures, and automatically trues the wheel during the cycling.

At the second station, the two construction holes are core-drilled and bored. When a fixture indexes to the station, the work-head slides forward to core-drill, then forward once more to bore. (Center distances between the drilling and boring spindles are such as to permit the inoperative spindles to clear the work during the feed stroke.)

In the next qualifying operation, pads and window frames on both sides of the case are machined simultaneously by straddle milling on a Davis & Thompson Roto-Matic. A similar machine then straddle-mills the torque-converter face and the rear-bearing face, in the final qualifying op-

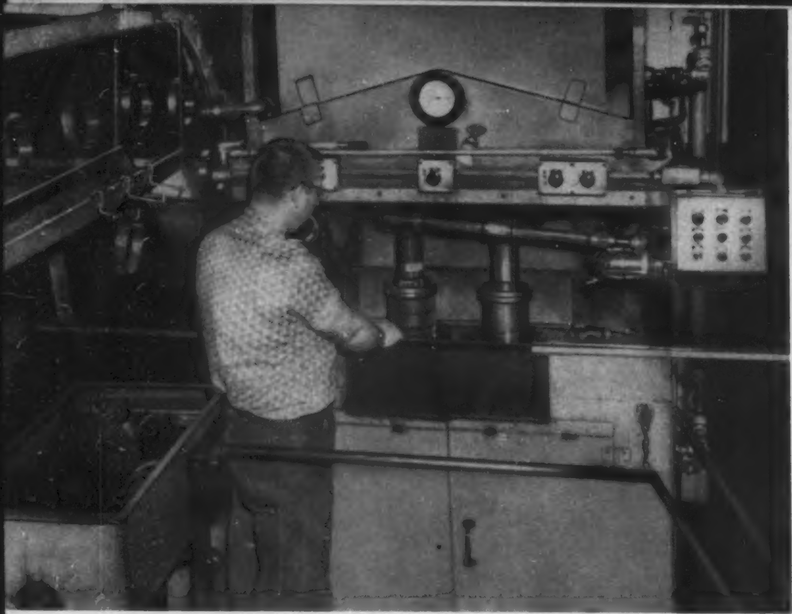
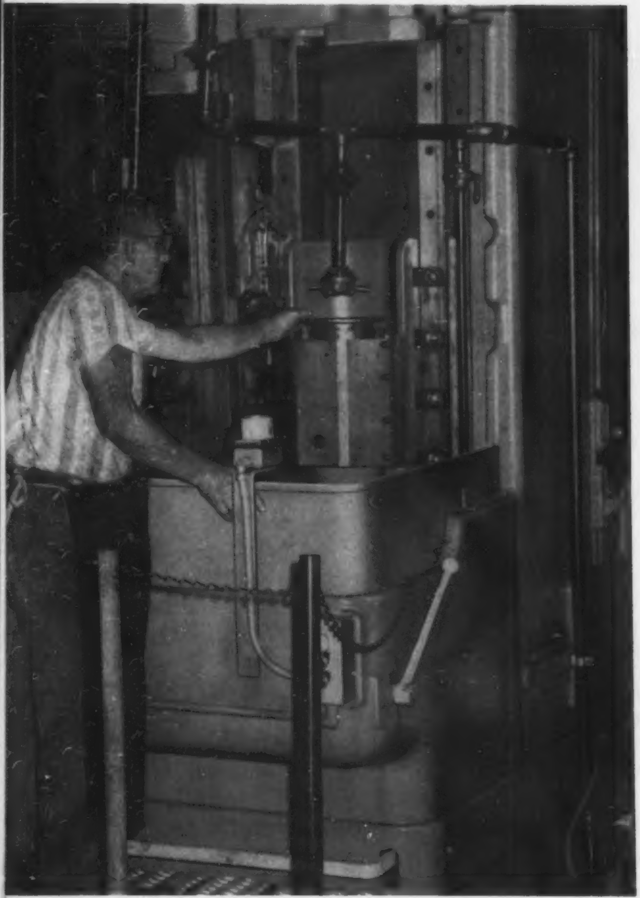


Fig. 1. One ring gear is roughed and another is finished simultaneously on this dual-ram pull-up broaching machine. The tools are 6 feet long and weigh about 800 pounds each.

Fig. 2. Sixteen broaches grouped on the inside of a hollow head descend over the apply plate, forming both sides of eight ears spaced around the periphery of the work.



eration. A view of the first machine appears in Fig. 4. The work-carrier is a "Ferris wheel" which rotates slowly and continuously, intersecting the center line of the two machine spindles.

In the illustration, cases are being clamped completely around the circumference of the carrier, the operator loading and unloading them in a continuous cycle. The castings are located on the ground oil-pan surface over two pins which engage the construction holes.

There are separate roughing and finishing work stations on both sides of the carrier. Each station has a spindle carrying a large carbide face mill which runs at 350 sfpm (surface feet per minute).

Before any additional machining of the case is undertaken, a porosity test is performed. The equipment for this is located immediately ahead of the transfer line. Cases are received from a conveyor, and upon entering the device all cavities and open areas are sealed automatically by hydraulically operated rubber pads.

When the pads are all in position, the build-up in the hydraulic circuit causes the air-test cycle to start. Air under a pressure of 60 psi enters the casting. Porosity in any of the cored passages creates a loss in pressure which is signaled by a red light, and the defective casting is removed from the production line.

Upon leaving the pressure tester, the transmission cases enter the first of three Buhr transfer lines which are arranged in tandem. The first line has twenty-one stations, the second has fourteen, and the third, three. In the heading illustration the operator is shown at the control console at the start of the first line. The rails seen in the foreground extend from the pressure tester.

At each station on the lines, the cases are lo-

Fig. 3. The first qualifying operation on the transmission case consists of grinding the oil-pan surface and core-drilling and boring two construction holes, on this rotary indexing machine.

Fig. 4. As the cases rotate around the "Ferris wheel," the torque-converter face and the rear-bearing face are straddle-milled. Cases are located on the oil-pan surface which was ground in the first qualifying operation.

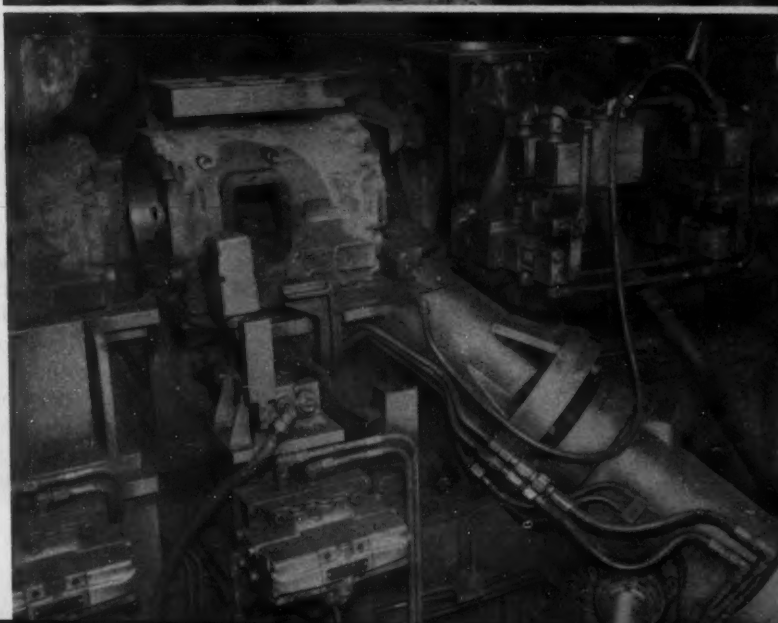


Fig. 5. Located between the first and second transfer lines, this turnover station automatically up-ends the case and turns it 90 degrees around its long axis.

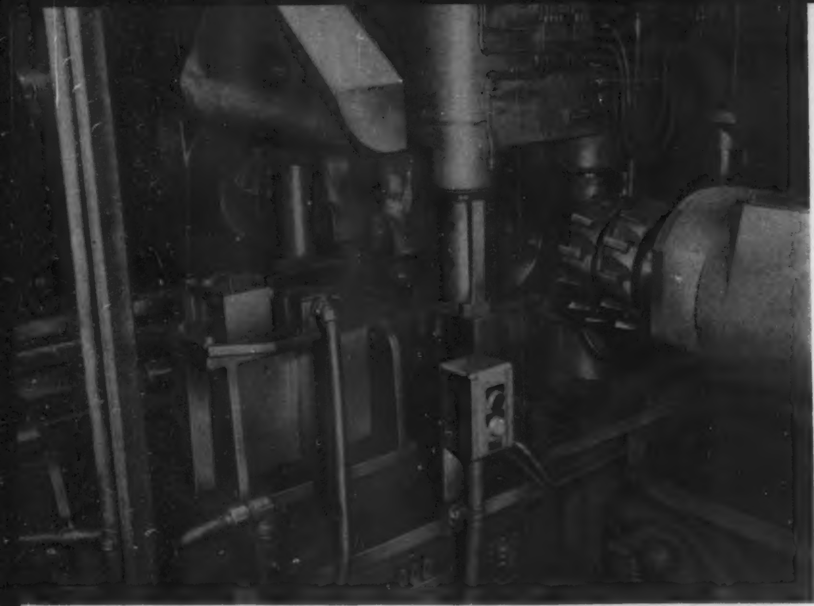


Fig. 6. The two ends of the case are finish-bored, counterbored, and chamfered at this station—the last machining station on the third transfer line.

Fig. 7. Clutch plates are permitted to float in the nests as the fixture rotates between the two wheels of the grinder, thus producing a crosshatch pattern.

cated against the ground oil-pan surface and by shot-bolts in the two construction holes. A bar pushes against the opposite side of the casting to lock it against the rails. Upon leaving the various drilling, reaming, tapping, and probing stations in the first line, the work enters the turnover station shown in Fig. 5. As the case moves into this station, it interrupts the beam of a photoelectric cell, causing the turnover fixture to operate. Arms grasp the case, and the fixture, mounted at an angle, pivots to up-end the case as well as turn it 90 degrees on its long axis.

A close-up view of one of the machining stations appears in Fig. 6. Here, the two ends of the case are simultaneously finish-bored, counterbored, and chamfered. Diameters are held to plus or minus 0.001 inch, and concentricity to 0.002 inch, total indicator reading.

Several thin components of the transmission require a high degree of flatness and parallelism in surface-grinding operations. Instead of holding the work rigidly against the grinding wheel, it is allowed to float in a nest, so it is free from any stresses set up by clamping. Round parts will revolve around their own axes in the nests, so the grinding produces a desirable crosshatch pattern.

One of the "float-grinding" setups appears in Fig. 7. The particular parts illustrated are clutch plates (shown being broached in Fig. 2). A Gardner double-head disc grinder handles the job. Both wheel-spindles, one on each side of the nest, are set at a compound angle to provide an entrance opening for the parts. This also gives a rougher grinding action at the beginning of the cycle and a smoother action at the end of the cycle. After each batch of parts is rough-ground,

they are run through again for finish-grinding. Flatness is held to within 0.0025 inch.

Grease Equalizes Sleeve Pressure

Carrier output shafts undergo a series of drilling operations on the equipment illustrated in Fig. 8. This machine, designed and built by Allison engineers, consists of three self-contained units arranged vertically around an indexing table. This equipment drills and reams four pinion-pin holes in the carriers. The holes, 0.7005 inch (plus 0.0000, minus 0.0006 inch) in diameter, must be parallel to the carrier axis within 0.001 inch. A noncumulative tolerance of 0.001 inch is maintained between the holes. Also, the holes in both flanges of each carrier must be in line within 0.0005 inch.

Parts are loaded in Hydralok fixtures mounted on a dial that indexes from a load-unload station to the self-contained units. Each fixture is a plate having a thin metal sleeve set in the contact area with O-ring seals. Grease is packed behind this sleeve. Turning a small screw applies pressure to the grease and expands the sleeve equally all around. In this way, the work is located from its true center, regardless of dimensional variations. Drilling is done by the first unit; rough-reaming and finish-reaming, by the second and third units. Reamers are piloted both above and below the work-pieces.

In Fig. 9 is shown a close-up view of the submerged-arc welding of a high-clutch housing sub-assembly. A Peck welder is used. With the work located on elevating pins, the hub (8620 steel) is welded to the mild-steel housing. A backup bead is laid down in the first setup. After completing a batch of parts, the sub-assemblies are turned over and, with a different fixture in place, flush inside beads are laid down. The maximum height that is permissible for this weld bead is 0.020 inch.

Fig. 8. Pinion-pin holes in carrier output shafts are drilled and reamed on this company-developed machine. Work on indexing table is centralized and held by grease-actuated sleeves.

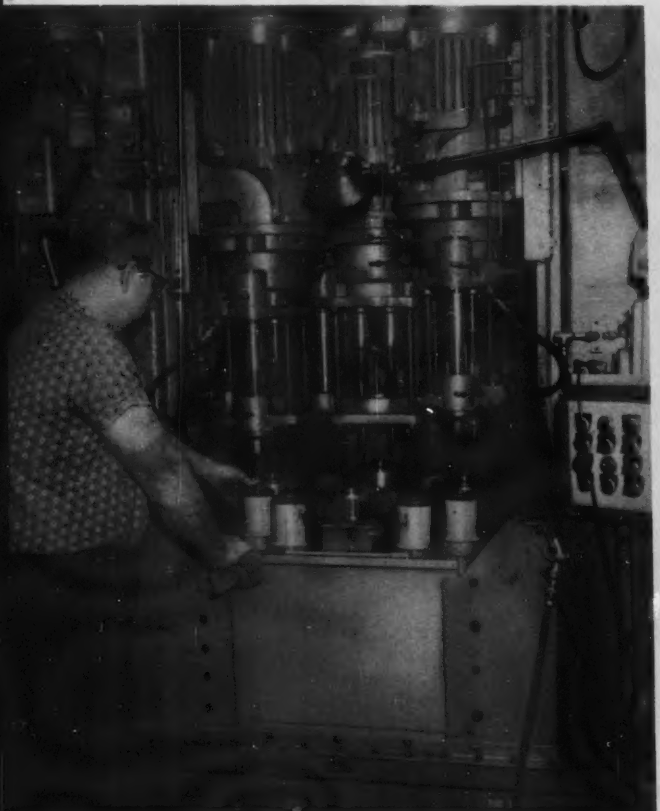
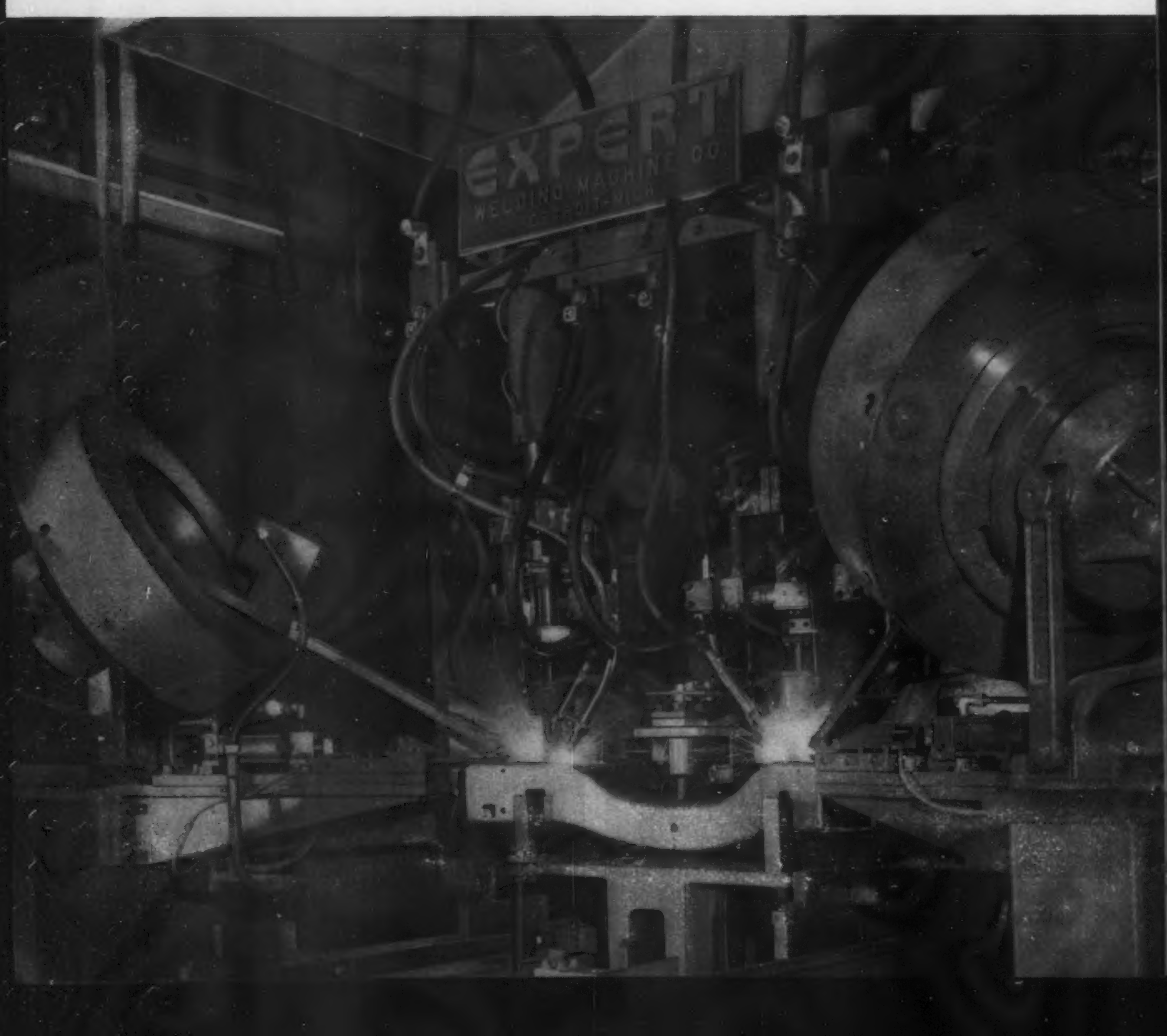


Fig. 9. High-clutch housing sub-assemblies are welded by a submerged-arc technique. After a backup bead is laid down, the sub-assembly is inverted for an inside bead.

Automatic, contour arc welding of components with carbon-dioxide shielding gas, an automated final assembly line, and a unit for automatically stacking the painted assemblies are features of the facility for producing stub frames used in Unibody construction

CHARLES H. WICK, Managing Editor

Welding of Stub Frames



for the Chrysler Unibody

UNIBODY—a semiunitized type of body construction—is a feature of the 1960 Plymouth, Dart, Dodge, DeSoto, and Chrysler cars that permits combining lighter weight with greater strength. The body has two structural trusses made up of box sections extending upward from the sills, along the roof, and downward at the rear to a solid foundation in the rear-wheel housings. Connecting these two structural trusses are heavy transverse members that span the unit body at the floor pan, cowl, and upper and lower edges of the windshield and rear window. The trusses insure the desired strength of this structural assembly.

The front structure and the radiator, fenders, shields, and panels are integrated on a stub frame which is bolted to the unit body. At the rear, fully boxed, longitudinal framing members and transverse channel sections support the drive and rear-suspension elements, thus adding to the body rigidity. Heavier sills are used, in many cases being two to three times thicker in underbody areas than in previous models. Bulkheads are welded into the sills to provide even greater strength and rigidity in the semiunitized bodies of the 1960 cars.

In static structural tests conducted at Chrysler's engineering laboratories, the new four-door sedan bodies showed a 100 per cent improvement over conventional body-and-frame construction in torsional rigidity, and a 40 per cent increase in beam strength. Approximately 5300 spot welds and 61 feet of gas and arc welds are made on each Unibody.

Facilities for the production of the stub frames at the Mack Ave. plant of the Chrysler Corporation feature a number of automatic, contour-following welding machines, and considerable automation equipment. A typical stub frame employed in Unibody construction is illustrated in Fig. 1. Major components of the frames include inner and outer rails, cross-members, and various brackets. The frames for different model cars vary slightly with respect to the number of cross-members and brackets, as well as the length of the rails.

Inner and outer rails are contoured, channel-shaped members formed from steel sheets having thicknesses of 0.093 and 0.078 inch, respectively. Each pair of inner and outer members is joined by two continuous, contoured lap welds at the junctures of the upper and lower flanges to form a rigid, box-section side rail. The Nos. 1 and 3 cross-members are of open-channel construction with welded reinforcements, and are press-formed from 0.093-inch-thick steel. Two channel-shaped members, formed to the required contour from 1/8-inch-thick steel plates, are welded together to form the box-section No. 2 cross-member.

Automatic welding of most of these components is done by the direct-current, reverse-polarity, metal-arc process, using carbon-dioxide gas for shielding. Consumable electrodes, in the form of bare welding wire, and high current densities are employed. Advantages of this process include high welding speeds and the production of consistently clean, sound welds of high quality, with rapid deposition and minimum distortion. Also of major importance, the cost of the carbon-dioxide shielding gas is nominal—only a small percentage of that for argon or helium

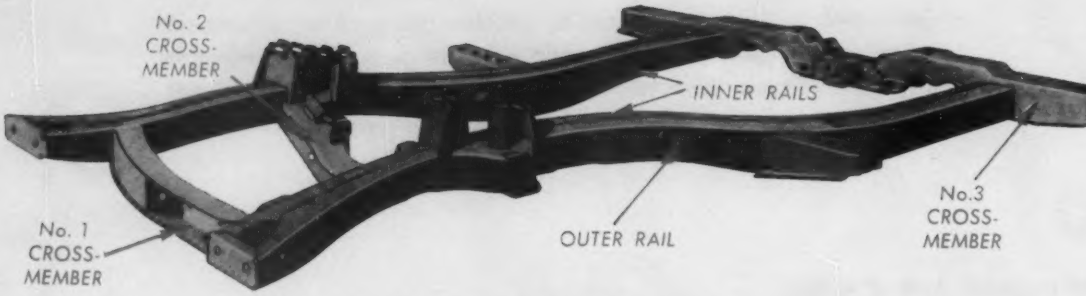


Fig. 1. Stub frame for Chrysler Unibody consists essentially of inner and outer rails, cross-members, and various brackets.

gases frequently used for shielded arc welding. Another advantage is the absence of flux and slag, which would wear the work-holding fixtures.

Automatic contour welding of the two channel-shaped stampings to form the box-section for the No. 2 cross-member is done on the Expert machine shown in Fig. 2. This machine is equipped with four Westinghouse automatic welding heads, two per side, which complete a total of 64 inches of linear welding. Each head completes half of one of the two seam welds, the heads starting at the center and welding toward the ends of the work-piece.

Bare welding wire, 3/32 inch in diameter in this instance, is fed continuously through the automatic welding heads. The wire is supplied from drums that have an inner cylindrical core around which the welding wire is wound. Each drum holds 750 pounds of wire. Approximately 520 inches of weld can be made per pound of 3/32-inch-diameter wire, and more than 1100 inches with 1/16-inch-diameter wire. The low-alloy, mild-steel wire used for this and all other automatic welding operations performed on the stub frames contains 0.13 to 0.19 per cent carbon, 0.95 to 1.30 per cent manganese, and 0.45 to 0.60 per cent silicon, with maximum percentages of 0.025 phosphorus and 0.035 sulphur. A high silicon content is specified to minimize the drop size when the wire is melted.

During welding, an envelope of the carbon-dioxide shielding gas surrounds the arc. This excludes air and impurities, and prevents contamination of the weld metal. No flux is needed, and there is no slag formed on the weld metal—thus eliminating the need for cleaning and chipping. However, all parts to be welded in this way must be thoroughly cleaned. This is accomplished by spraying with a hot, aqueous cleaning solution, rinsing in water, and drying the parts prior to welding. Side delivery of the carbon dioxide to the weld area is used (instead of a concentric shielding tube around the wire) to facilitate maintenance. This consists of periodically removing spatter from the supply tube to insure a full flow of gas. Consumption of the carbon dioxide is at the rate of 30 cubic feet per hour during welding, with the flow being turned on and off at the

Fig. 2. Four heads on this automatic machine contour-weld two channel-shaped stampings into a box-section for the No. 2 cross-member.

beginning and end of the cycle by means of electrical controls.

Welding is performed in this and all the other automatic operations at rates varying from 100 to 200 inches per minute. It is possible to weld up to 300 inches per minute in this way, but this would necessitate consistently perfect alignment of the mating edges on all parts, which is extremely difficult to maintain in production. The increase in production obtained can be appreciated when it is realized that hand arc welding can only be done at an average of 15 to 20 inches per minute.

Automatic contour welding with carbon-dioxide shielding does not lend itself to uphill welding. Consequently, the parts are positioned in the fixtures to permit downhill welding (at an angle of approximately 20 degrees) whenever possible. This permits faster, higher-quality welding than can be done with the weld surface horizontal. In the case of the No. 2 cross-member, the components are loaded upside down in the fixture to permit downhill welding. Also, the wire is traversed while being held at an angle, rather than perpendicular, to the seam being welded. This minimizes penetration and allows more leeway in fit-up of the stampings.

Current densities of up to 100,000 amperes per square inch or more are used—a current of 700 amperes is employed with 3/32-inch-diameter wire, and 450 amperes with 1/16-inch-diameter wire. (In hand arc welding, a current of 200 amperes is used with 3/16-inch-diameter electrodes.) Westinghouse constant-potential, direct-current rectifiers are provided which automatically increase the current to maintain the preselected arc voltage of 25 to 28 volts.

Tolerances on the contoured edges of the stampings to be welded and proper fit-up of the parts in the welding fixture are critical factors influencing the success of automatic welding. Variations in the actual contour of the weld lines —due to the tolerances allowed in stamping, the spring-back of the metal after forming, and commercial thickness variations—make it impractical to employ automatic welding machines that are entirely contour-controlled by suitable cam arrangements.

Compensation for vertical variations in the weld-line contour is automatically made on the Expert machines by means of a mechanical follower system and memory device. With this system, the basic welding-head carriage follows the specified design contour of the components to be joined by means of contour cams built into the machine itself. Simultaneously, a mechanical probe connected to the tracer system follows the actual weld-line contour of the work-pieces. The difference, or "error," between the specified design and actual contour is then transmitted to the mechanical memory unit, where it is temporarily stored. This information is then transmitted to the welding head, which is then correctly positioned on the actual weld line.

The entire mechanical follower system is mounted on and driven by a carriage. A sub-slide, mounted on the carriage, follows the design contour cam—*A* in Fig. 3—through a secondary cam follower. This cam follower is 3 1/2 inches ahead of the primary cam follower that guides the vertical path of the entire carriage from the design contour cam. A probe resolver mechanism *B* and a differential linkage *C* are connected to the sub-slide. The probe resolver mechanism is a double parallelogram which supports the probe, allowing it to follow the actual weld line *D*. The total motion of the probe is resolved so that only the vertical component is picked up by the differential linkage. Therefore, when the probe and secondary follower move in

Fig. 3. Mechanical follower system and memory device employed to automatically compensate for variations in the weld-line contour.

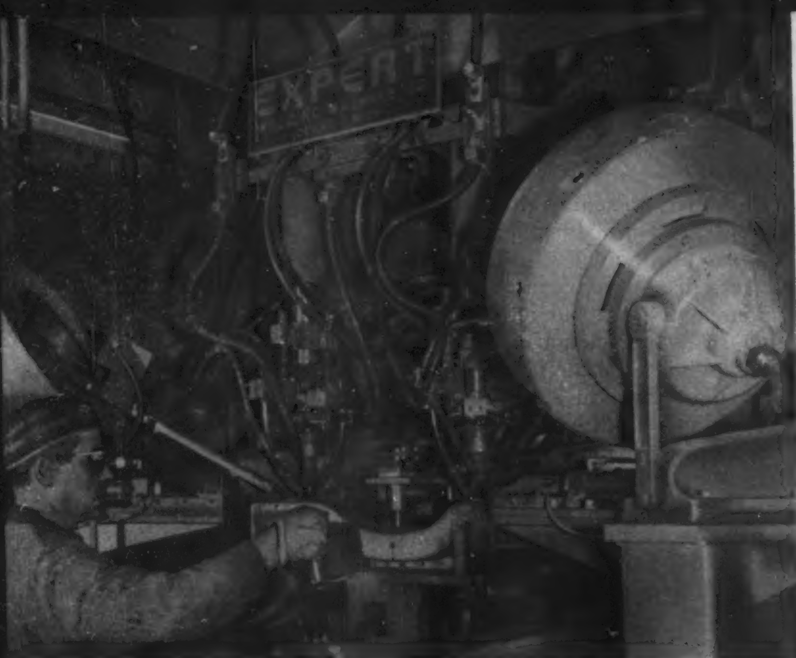


Fig. 4. Two washers are welded to each No. 2 cross-member on this machine. Hoppers and loading chutes automatically position the washers.

Fig. 5. Automatic, cam-controlled machine for welding two reinforcing members inside the ends of the channel-shaped No. 1 cross-member.

the same vertical position at the same time, there is no error between the design contour cam and the part. Thus, there is no error output from the differential linkage. However, any variation between the secondary follower movement and probe vertical movement is an error, and results in a proportional horizontal movement of the linkage connector bar.

This movement is converted to a vertical movement at the input shaft E of the sealed, mechanical memory unit F, through a bellcrank connector link G. The input shaft then provides an input to the memory unit, equal to the error between the design and actual contours. The memory unit stores this error information for a short period of time and then relays it to the slide H to correctly position the welding head J.

The memory unit consists of a drum K, which is driven in synchronism with the carriage, and contains a number of set pins L. Connected to the memory-unit input shaft are two set cams which position the set pins according to the input shaft's vertical position. The vertical position of the memory-unit output shaft is determined by a roller which rides on top of the set pins. As the pins move past the set cams of the input shaft, their vertical position is determined by these cams, and the pins are locked in place. This vertical position records the error contour. As the pins move past the output shaft, the roller riding on top of the output shaft "reads out" this information to the welding head. The head, mounted on a sub-slide, moves up and down according to the error correction output from the memory

Fig. 6. Channel-shaped, inner and outer rails are joined to form box-section side rails on this four-station, automatic, contour welder.

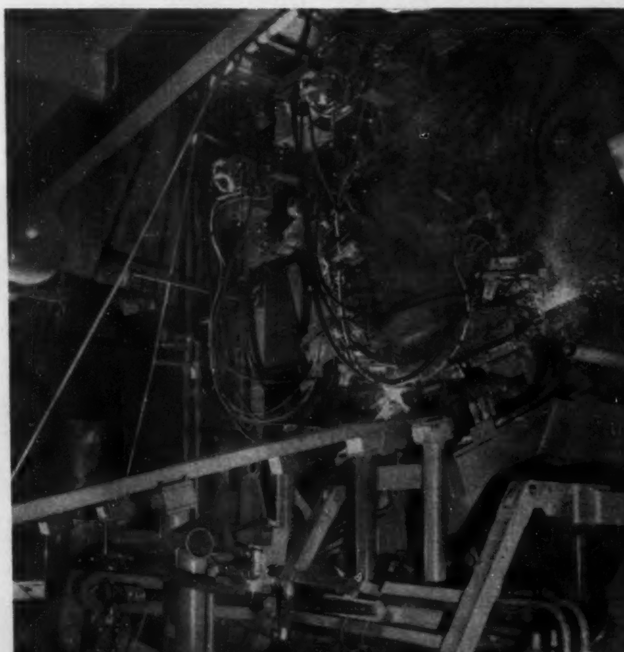


Fig. 7. Rear view of machine illustrated in Fig. 6 shows how the contour-welded side rails are automatically unloaded from fourth station.

unit. After having passed the output shaft, the vertical positions of the pins are "erased" by a set of fixed cams which unlock the pins and push them to their lowermost position. The tracer system is completely self-contained and requires no external wires, amplifiers, power sources, or valves.

Welding of two washers, 2 inches in diameter by 1/8 inch thick, to each No. 2 cross-member is done on the Expert machine seen in Fig. 4. These washers reinforce the mounting holes for the lower control-arm pivots. The cross-members are carried into the welding fixture by a manually loaded shuttle and ejected at the rear. The washers are automatically positioned on the work by chutes leading from hoppers—one washer from each hopper per cycle. The automatic cycling machine is equipped with four Westinghouse wire-fed, carbon dioxide-shielded welding heads. Two heads are used to weld each washer to the cross-member, the heads rotating approximately 180 degrees while the work is held stationary.

Two heavy reinforcing plates with their inner portions bent downward at an angle of 15 degrees are welded inside the ends of the channel-shaped, No. 1 cross-member on the United Welders machine shown in Fig. 5. This automatic, cam-controlled machine is equipped with six General Electric welding heads, three at each of two stations. In this operation, the welding wire must be fed perpendicular to the weld line because of the confined area. However, the welding guns are pivoted horizontally as they are

Fig. 8. "Tomato-can" welder is employed to produce front shock-absorber supports by welding washers inside tubular members.

traversed along the weld lines, and vertically cammed down the 15-degree slope.

The channel-shaped, inner and outer rails are joined to form the box-section side rails of the Unibody stub frames on Expert automatic, contour following welding machines, such as the one seen in Fig. 6. Four of these machines are provided, two for left-hand and two for right-hand assemblies. Each machine has four stations (assembly, idle, welding, and ejecting) and four Westinghouse welding heads. A total of 20 linear feet of welding is required per stub frame—10 feet along the left-hand side rail and 10 feet on the right-hand member, and each head completes 2 1/2 feet of welding.

Inner and outer rail components are manually loaded into a fixture at the first station on the machine. Here the channel-shaped parts are press-assembled with air clamps. The assembly is automatically transferred to the idle station, and then to the welding station, by means of a hydraulically operated, walking-beam type shuttle mechanism. An idle station is provided to reduce the distance the assemblies have to be shuttled, and to furnish ample space for maintenance.

In the welding station, the channel-shaped rail members are secured in a fixture with air and hydraulic clamps. Sufficient pressure is exerted to minimize joint gaps and counteract distortion of the assembly due to welding. Bronze jaws grip the parts within 3/8 inch of the joints to be welded along the entire length of the assembly. A toggle linkage mechanism powered by a hydraulic cylinder raises one end of the assembly and fixture into the downhill welding position. After the heads have completed their automatic contour-welding cycles, the work-holding clamps are released, the fixture is lowered, and the side rail is automatically shuttled to the ejection station and unloaded. The unloading end of the machine is seen in Fig. 7.

A washer, 2 1/2 inches in diameter, is press-assembled and fillet-welded inside one end of a tubular member, 4 1/2 inches long, to form the front shock absorber support, on the so-called "tomato-can" welder seen in Fig. 8. This Expert five-station, automatic-cycling, rotary-indexing welding machine is equipped with two carbon dioxide-shielded, General Electric arc-welding heads to complete two "cans" per cycle. At the first and second stations on the rotary indexing table, tubular members are manually placed on the two spring-collet fixtures mounted at an angle of 45 degrees at each station, and a washer is placed in the top of each member. When two of the assemblies have been automatically indexed to the third station, the washers are pressed the specified distance into the tubes by means of two air-operated presses, thus sizing the tube bores slightly. At the fourth station, the assemblies are rotated below the heads which feed coiled electrode wire, 1/16 inch in diameter, to complete the fillet welds between the washers and tubes. Completed shock-absorber supports are automatically

ejected onto a conveyor chute at the fifth station by means of air-actuated rams.

A camber-adjustment cam-retainer is added to both sides of each of the four upper control-arm brackets on two automatic arc welders, Fig. 9, made by the Resistance Welder Corporation. Carbon-dioxide shielding and bare welding wire 1/16 inch in diameter are used for this operation. The brackets are manually loaded on one of four mandrels protruding radially from an indexing device, and the retainers are automatically fed into position—one from a manually loaded magazine chute and the other from a hopper-fed magazine chute. Each machine has four General Electric heads, and each pair of heads completes two 3/4-inch-long welds to join one retainer to a bracket.

Final assembly of the stub frames is done on two in-line transfer lines, each containing thirty-three stations. The first ten-station section (80 feet long) of each assembly line was built by Wilson Automation Co., and the remainder by Centri-Spray Corporation. The loading end of one line is shown in Fig. 10. A total of sixty hand arc-welding operations are performed at the various stations along each completely automated line. An equal number of manual welders are required for off-line operations of adding brackets to the sub-assemblies.

At the first station, the five main sub-assemblies—two side rails and three cross-members—are manually assembled, without welding, in a fixture in an inverted position. The assemblies are automatically transferred between the first ten stations by a lift-and-carry shuttle mechanism. Four of these stations contain fixtures with hydraulic clamps. At the next few stations, the sub-assemblies are manually welded together and inspected, and repaired if necessary. An automatic turnover fixture at Station 7 rotates the stub frames through an angle of 180 degrees in a vertical plane. On stub frames for Dodge cars, a fourth cross-member is added at the front end of the frame in the eighth station, while the rear cross-member is further secured by the application of four automatic resistance type spot-welding guns.

Stub frames are transferred to the Centri-Spray line at Station 11. On this portion of the line, the frames are indexed from station to station by means of a pusher type conveyor—the frames sliding on rails and the pusher dogs retracting after indexing 8 feet. At subsequent stations, welding, inspecting, and repairing operations are performed. Upper control-arm brackets, both front and rear, are added at Station 23. Four hand arc welders apply two welds per bracket while the frame is lifted clear of the conveyor in a clamping fixture. The frames are pivoted through an angle of 50 degrees by means of tip-up fixtures at the twenty-fourth and twenty-fifth stations to facilitate welding the brackets to the inner surfaces of the side members.

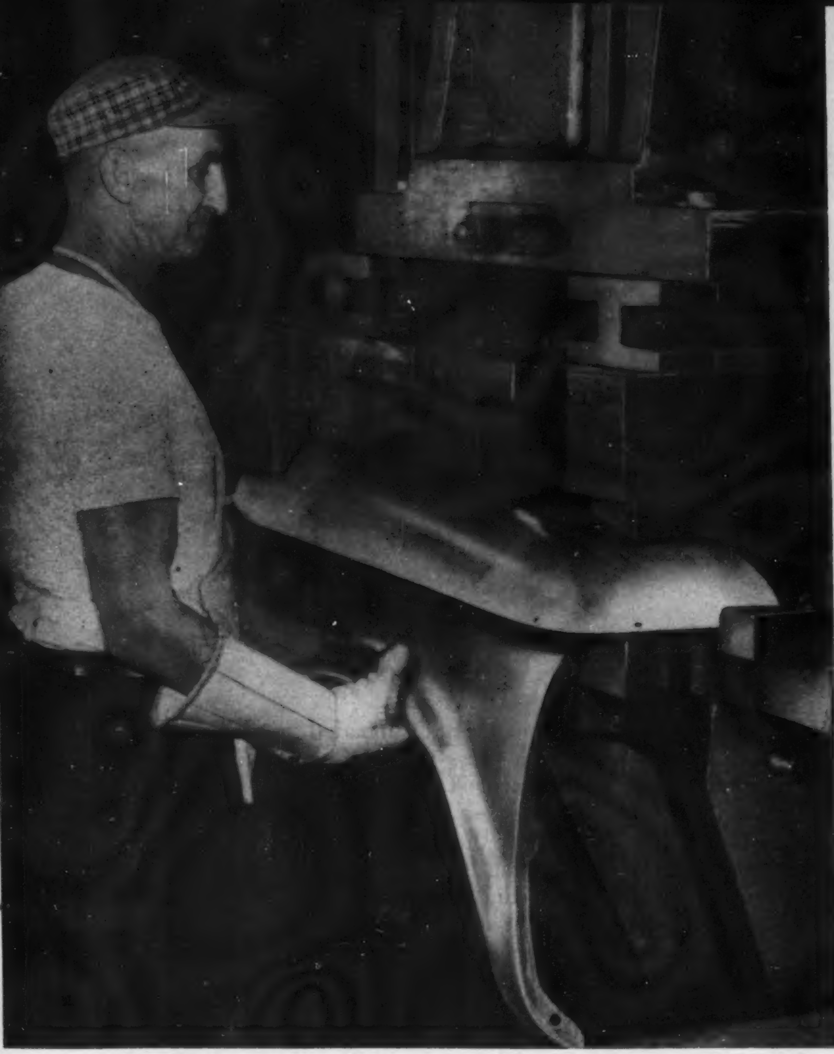
At Station 30, Fig. 11, two body bolt holes in

Fig. 9. Automatic arc welder using carbon-dioxide shielding and low-alloy welding wire as the electrode to join camber-adjustment cam-retainers to control-arm brackets.

Fig. 10. Loading end of one final assembly line for stub frames. This line has thirty-three stations, and a total of 60 arc-welding operations are performed.

each of two brackets are increased in diameter from 5/8 to 7/8 inch and realigned with other body bolt holes in the rear cross-member by means of four punches mounted on hydraulically actuated piercing units. The stub frames are transferred from the ends of both final assembly lines to a single, transverse shuttle unit that connects the ends of the two lines to form a U-shape. As each frame reaches the center of this shuttle, the front (trailing) end is swung downward into a pit in the floor as the rear cross-member is encircled by twin hooks traveling on an overhead monorail conveyor. This transition is accomplished by a Centri-Spray automatic frame-transfer mechanism. The conveyor carries the frames through wash, rinse, air-dry, paint-dip, and oven-bake operations. Painted stub frames are automatically removed from the conveyor and stacked in vertical piles, each containing from eight to eleven frames, ready for shipment to assembly plants. The automatic ratchet-operated stacker is a labor-saving development of the Wilson Automation Co.

Fig. 11. Hydraulic piercing units at Station 30 enlarge diameter of body bolt holes in brackets from 5/8 to 7/8 inch and insure proper alignment.



The stamping of fenders and grille panels, two of the many items being manufactured on the company's heavy press lines, will be described. Explained also is the procedure for sub-assembling hoods for the Lark line of automobiles

Stampings for Studebaker's Convenience-Size Lark

E. J. LIEVENS, Manager, Stamping Plant
Studebaker-Packard Corporation, South Bend, Ind.

FIRST complete line of body styles in the convenience-size car field has been rounded out by the Studebaker-Packard Corporation with the addition of two Lark convertibles and four models of four-door station wagons. Design changes for the 1960 models are mostly "under the hood"—the distinctive exterior features introduced last year have been, for the most part, retained.

With Studebaker's 1959 sales almost triple those of the previous year, its manufacturing facilities were kept operating at a high pitch. In anticipation of an equally good, or better, year ahead, the company's various plants are again going ahead at full speed. No exception to this statement is the stamping plant. All of the heavy press lines are in full swing turning out the many stampings for the Lark and Hawk lines of automobiles.

Lark Grille-Panel Line

Typical of these stampings is the grille panel for the Lark, of which about 1050 are produced each day. They start off as rectangular blanks of cold-rolled, 19-gage (0.0418-inch-thick) special aluminum-killed steel of drawing quality. By using killed steel, no preliminary roll-flexing of the blanks is required for purposes of stress relief.

Fig. 1. Grille panels for the Lark are drawn on this 750-ton double-action press. By using aluminum-killed steel for these parts, preliminary roll-flexing of the blanks is unnecessary.

Blanks are stacked in front of a 750-ton Clearing double-action draw press, Fig. 1. Two operators place each blank by hand into the draw die, where it is located against three 1/2-inch-diameter pins. Compressed-air guns (one of which can be seen hanging in front of the operator at the right) are used to spray a film of lubricant on the surface of the sheet metal. At the end of the draw stroke a pair of ejectors raise the panel clear of the lower die member and a third operator (seen behind the press) removes it. The grille panel, which is completely drawn in this one operation, is placed on a powered Rapistan belt conveyor for delivery to additional presses in the line.

Trimming is the next step. This is done in the 500-ton Clearing press shown in Fig. 2. The panel is again loaded and unloaded by hand, with transfer from press to press being accomplished by a series of belt conveyors. More than trimming of the excess metal is done at this point. As can be seen by the part being removed from the press, punching of several openings is also handled by the die. Among the areas punched are both headlight openings, both air-scoop openings, the grille opening, and the bumper-mounting slots.

Two operations take place simultaneously in the next two 500-ton presses. The first carries two sets of dies. Mounted on the right-hand side of the bolster is a flange-wiping die. When a trimmed panel has been positioned (face down) and the press closed, the flange all around the part, with the exception of the immediate grille

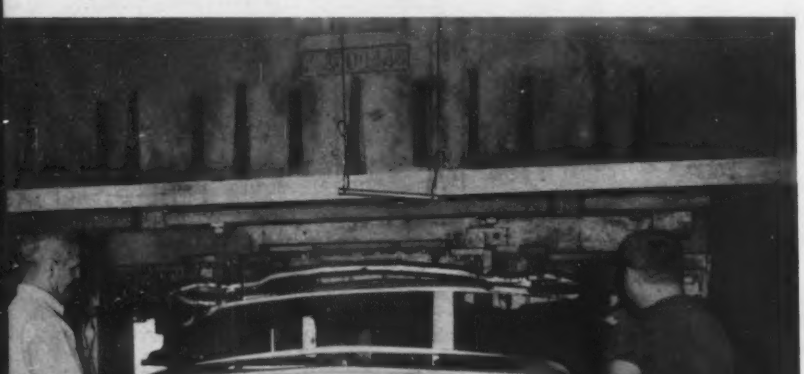


Fig. 2. Second step in the grille-panel line is trimming in this 500-ton press. Several openings, including those for the headlights, air scoops, and grille, are punched at the same time.

Fig. 3. Dies for two different operations are mounted in one press. Flange-wiping die (right) works on the top of the panel, while the other die (left) cam-flanges one side of the panel.

area, is wiped up. A pad in the center of the lower die member is supported on an air cushion and moves down under pressure of the punch, thus providing the necessary wiping action against the stationary outer die section.

A smaller die, mounted on the left-hand side of this same bolster, cam-flanges the right-hand side of the grille panel. Because the die performs a localized operation, it is comparatively small, necessitating an outrigger type of support arm to maintain the work in proper position. As both dies are in the same press, one man is assigned to loading and unloading each of them. To speed up the flow of panels along the line, the press is tripped only when both dies have been loaded.

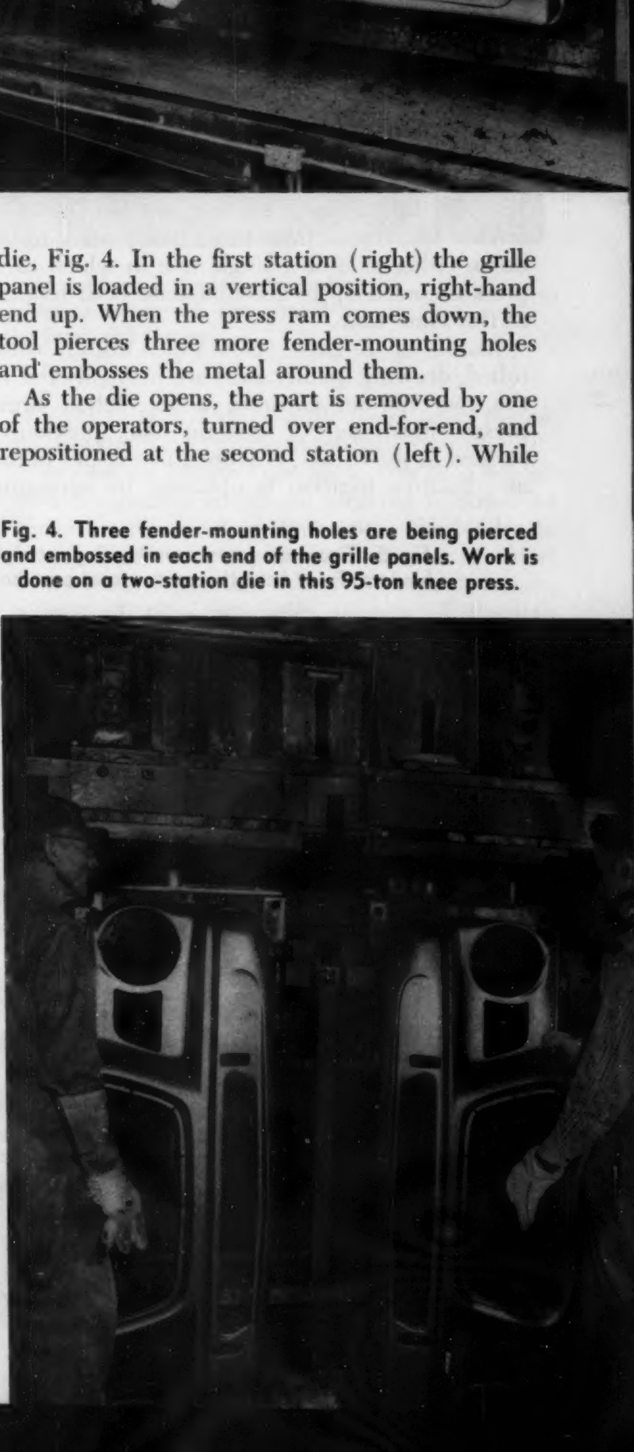
Second of the two similar press setups is shown in Fig. 3. At the right is a flange-wiping die. This tool works on a limited area, flanging only the top section of the grille panel that was not handled in the previous operation. A spring-loaded contour plate at the front of the upper die member contacts the work first and acts as a blank-holder while the rest of the tool wipes past the flange. The cam-flanging die seen at the left is of the same type as that already described, except that this one works on the left-hand side of the panel. Again, both dies are loaded before the press is tripped.

Further along the line the panels are again picked from the moving conveyor belt, this time at a 95-ton Bliss knee press. Here, the parts are positioned, one at a time, on a cam-piercing die. In this operation two fender-mounting holes are pierced on each side of the grille panel and the area around each hole is embossed.

A somewhat similar operation is performed at the next stop, also a 95-ton Bliss knee press. This press is equipped with a two-station cam-piercing die, Fig. 4. In the first station (right) the grille panel is loaded in a vertical position, right-hand end up. When the press ram comes down, the tool pierces three more fender-mounting holes and embosses the metal around them.

As the die opens, the part is removed by one of the operators, turned over end-for-end, and repositioned at the second station (left). While

Fig. 4. Three fender-mounting holes are being pierced and embossed in each end of the grille panels. Work is done on a two-station die in this 95-ton knee press.



this is being done, the other operator reloads the first die station. On the next stroke of the press the three opposite fender-mounting holes are pierced and embossed on the left-hand end of the panel. It might also be mentioned that at both stations of this die the contoured corners of the part are restruck to remove any wrinkles that might have occurred during drawing.

Right- and Left-Hand Fenders Handled in Single Press Line

A press line of more than casual interest is the one that shapes front fenders for the Lark. Although automatic material-handling equipment in the advanced state that we know it today is not widely employed here, high production rates (1050 per day with one shift) are realized in an interesting way. Two draw presses operate side by side, Fig. 5, each turning out one hand of fender. Conveyors from these two presses travel down either side of a single line in which each press is tooled up to accommodate both fenders at the same time.

Blanks of 19-gage (0.0418-inch-thick), cold-rolled, drawing quality steel are manually fed to the two 750-ton Clearing double-action draw presses illustrated. A locating hole, previously pierced in the blanks, is slipped over a pin in the die. Positive location is obtained by springing the sheet metal beneath a lip on each of two gages, one at the front of the die and the other at the rear of the die.

When drawn, the parts are lifted from the die and deposited on a powered conveyor belt. As seen in Fig. 5, the press in the background is forming left-hand fenders and the conveyor leading from it travels past the rear of the follow-up presses. In contrast to this, the press in the foreground is forming right-hand fenders and its conveyor travels past the front of the follow-up presses.

The first press encountered by the two streams of fenders is shown in Fig. 6. Two dies for preliminary trimming can be seen on the bolster—one for the left-hand fenders (rear) and one for the right-hand fenders (front). Four operators are used in this operation, two handling each fender. When both dies are loaded, palm buttons on all four corners of the press must be depressed before the ram is tripped. In this operation, excess metal is removed from the wheel-housing area and along the door line and grille-panel opening. Also, all molding and nameplate holes are pierced.

Final trimming is done in the next 500-ton press. As before, both right- and left-hand dies are set up on the bolster to handle fenders from the front and rear conveyors. Tripping of this press is accomplished by means of a trapeze type

Fig. 5. Two draw presses are turning out right- (foreground) and left-hand (background) front fenders. From here the parts travel past both sides of a single press line for further work.

Fig. 6 Both right- and left-hand tools, such as these preliminary trimming dies, are mounted in each of the heavy follow-up presses. The respective conveyor belts run past the front and the rear.

switch arrangement located well above each side of the machine opening.

A push-pull rod is suspended from a lever just below each switch and extends within reach of the operators. Pulling the rod pivots the lever in one direction and depresses the trip button. Pushing the rod pivots the lever in the opposite direction and depresses a press-stop button. Because of the double die setup, switches on both sides of the press must be depressed to initiate a stroke. During this operation the hood ledge and headlight areas are trimmed.

Next in line is a 500-ton Bliss press. A fender is removed from each conveyor and positioned in its respective die. At this press stroke the wheel-housing area, the door line, and the grille-panel opening are cam-flanged. The fenders are returned to their proper conveyors and are carried a short distance to either side of a 500-ton Clearing press. Here they are loaded in right- and left-hand dies and the hood ledge and headlight areas are cam-flanged.

It is at this point in the line that the multiple operations in a single press end. Along the remainder of the line the presses are smaller and are tooled for only one hand of fender. Layout of the two individual conveyors is retained, however, by having the subsequent presses installed back to back.

Going down one side of the line, the first stop after final cam-flanging is a 65-ton Toledo knee press. At this point two molding holes in the top of the fender and three grille-panel holes below the headlight area on the front flange are pierced.

At another Toledo knee press, this time one of 85-ton capacity, additional piercing is done. As shown in the heading illustration, the fender is placed lengthwise on the lower die and is seated in its normal position. When the ram descends, a row of grommet holes is pierced through the hood ledge by spring-loaded, cam-driven punches.

Main pressworking of the fenders is now complete. Nevertheless, there are three more stops to be made at the tail end of the line before the parts can be dispatched to the metal-finishing department. One of these is illustrated in Fig. 7. The door line of the panel is being stiffened by the addition of a rear reinforcement assembly. Two operators using Federal guns make two spots in the cowl area and three spots along the skirt.

These five spots are, in effect, nothing more than tack welds to lock the reinforcement assembly to the fender. In the next step the tacked end of the fender is positioned on a hemming die in a 95-ton Bliss knee press. As the die closes, a double-acting cam drives a rear forming member forward to bend the door-line flange inward through an angle of 45 degrees. At the bottom of the stroke the punch folds the flange over the edge of the reinforcement member, then applies pressure to flatten it.

Sixteen spots are made along this flattened

Fig. 7. A rear reinforcement assembly is being spot-welded to the fender door line. This constitutes a tacking operation prior to hemming of the flange and final welding.

flange on a multiple-electrode, Progressive spot-welding machine, Fig. 8, to finish the joint. The fender is turned to an inverted position and the back end is laid on fixture support blocks. An operator then slides the part forward beneath the electrodes until it contacts a stop behind them. This automatically trips the machine and the electrodes move down to make all sixteen welds simultaneously.

Sub-Assembly of Hood Panels

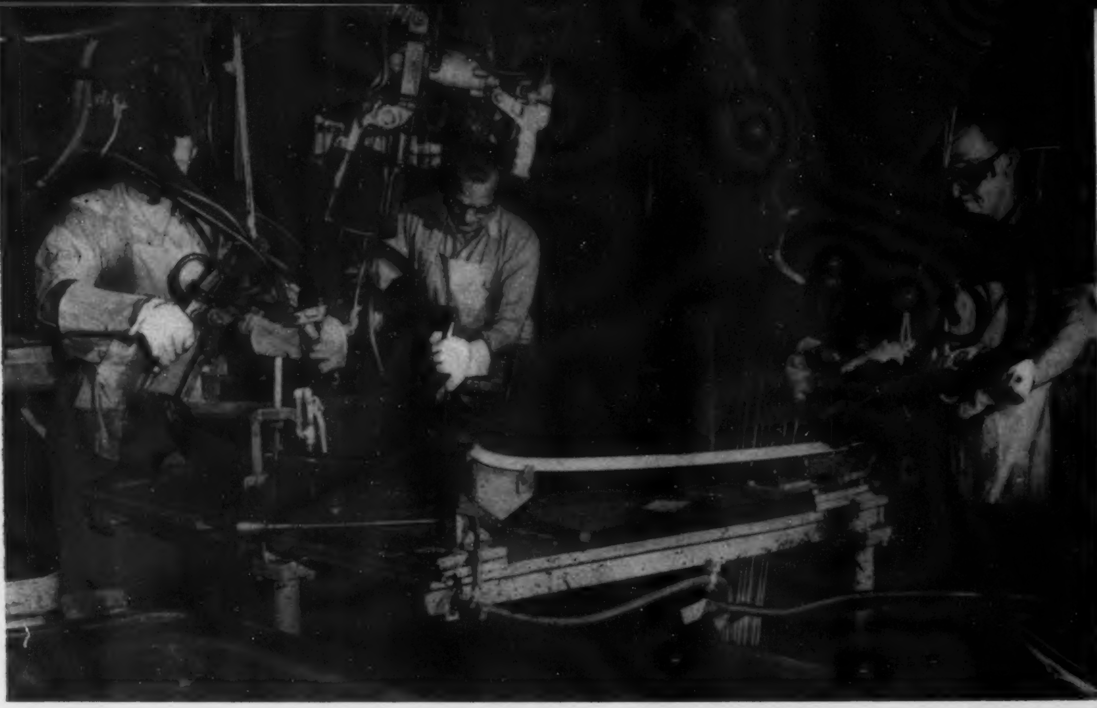
To get away from strictly pressworking operations, a typical stamping-plant sub-assembly is shown being made in Fig. 9. Hood panels for the Lark can be seen stacked in the background. They are taken, one at a time, and placed in an inverted position on one of two welding tables such as the one illustrated.

Shaped blocks, complete with edge stops, support all four corners of the hood. It is locked in place by three toggle clamps that are fixed to the table—one at the forward end of the hood and two at the rear.

Members to be added consist of a rear reinforcement sub-assembly (which includes the hood hinge brackets and studs), a front reinforcement strip, and a tubular diagonal bar with flattened ends. A special locating toggle clamp is used to secure the back end of the bar.

Four men usually attend each table, using spot-welding guns that are suspended from overhead like vines in a jungle. Seven spots are made on each side of the rear reinforcement sub-assem-

Fig. 8. Sixteen spots are formed along the hemmed and tacked rear reinforcement assembly on this multiple-electrode spot-welding machine. The machine is automatically tripped when a stop is contacted behind the electrodes.



bly and about forty spots along the front reinforcement strip. The diagonal bar is joined to the hood flanges by three spots at each of its flattened ends. The gun used for the rearmost end of the bar is equipped with two current-control buttons. One is depressed when joining two thicknesses of sheet metal, the other is depressed to yield a higher amperage flow when joining the thick flattened end of the bar to the hood flange, thus assuring a strong weld.

From the welding table the hood is transferred to a roller conveyor. While there, an operator sprays a stripe of oil across the underside of the panel about two-thirds of the way toward the rear. He then directs an air jet behind the rear reinforcement member to drive out any weld spatter, or "buckshot," from beneath it. As the spatter is blown out, it is trapped by the oil stripe and retained there during the next two operations.

The final two operations to be performed on the hood are very similar to the last two on the fender line. First, the back end of the hood is placed in a 95-ton Bliss knee press for the double operation of 45-degree flanging followed by flattening of the flange over the edge of the rear reinforcement member. Second, the part is passed to the multiple-electrode, Progressive spot-welding machine shown in Fig. 10. When the machine is tripped, eight electrodes (four in the center and two at each end) contact the hemmed flange simultaneously to complete the joint.

Fig. 9. (Above) This hood is a typical stamping-plant sub-assembly. An array of spot-welding guns is suspended overhead for joining a rear reinforcement sub-assembly, a front reinforcement strip, and a diagonal bar to the panel.

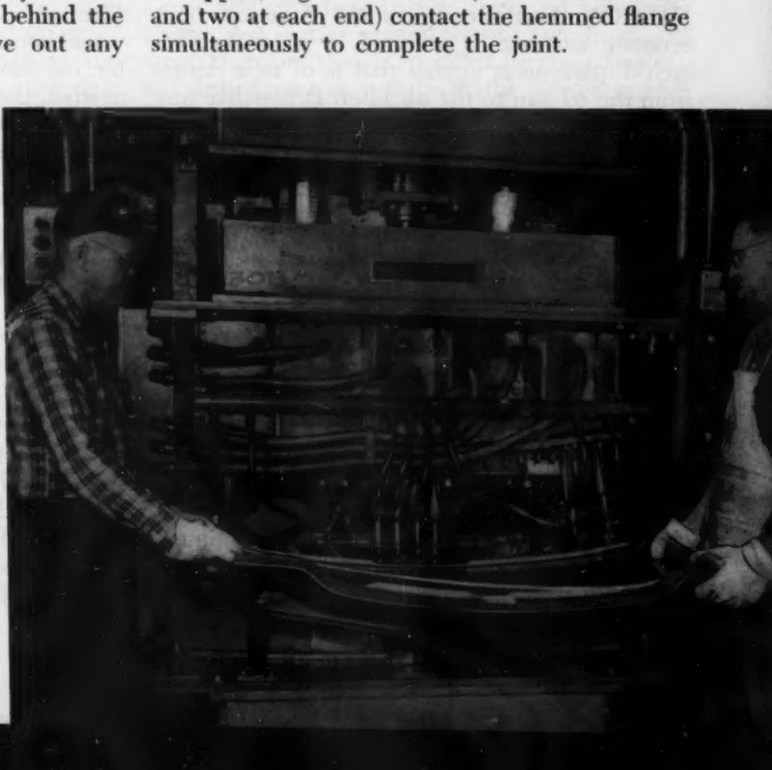


Fig. 10. (Right) Last operation on the hood. The rear flange has already been folded over the reinforcement sub-assembly and flattened. Here, the hood is positioned on a multiple-electrode spot-welding machine to seal the hem.

Ford Piston Lines Retooled for Falcon's Simplified Six

A smooth transition from pistons for high-compression V-8 engines to those for the all-new Falcon in-line six-cylinder engine has been achieved at Ford's Lima engine plant. Two lines have been torn down, then rebuilt and retooled to accommodate the smaller piston without the need of heavy expenditures for new equipment

RAYMOND H. SPIOTTA, Associate Editor

FALCON, Ford's entry in the American-built economy-car race, is powered by a 144.3-cubic-inch-displacement engine that is of new design from the oil pan to the air filter. It is unlike any other six-cylinder engine previously produced by the company.

Simplicity was the guiding thought behind it. Components were designed to perform given functions with the fewest possible parts. The overhead-valve engine is engineered to deliver 90 hp with a maximum economy in fuel and a minimum need for maintenance and repair. Part simplification is exemplified by the integration of the head and the intake manifold into a single casting—thus eliminating many bolts and bolt holes that would normally be required.

An acknowledged fact is that smaller cars are more sensitive to engine weight than are larger cars. Following this reasoning, there are areas where the weight differential between aluminum and cast iron or steel can be exploited to minimize the weight of ordinarily heavy components. One such application in this instance is the flywheel housing. By judicious use of aluminum and by reducing the number of individual pieces needed, the weight of the complete Falcon engine has been held to 345.51 pounds.

The engine has a 3 1/2-inch-diameter bore and a short, 2 1/2-inch stroke. This is a stroke-to-bore ratio of 0.7 to 1, yielding a 30-inch total piston travel for each revolution of the crankshaft. As a result, an unusually low friction index is obtained and less energy is wasted through heat.

Pistons Start Out on Transfer Machine

Permanent-mold-cast aluminum pistons, as delivered to the engine plant, are already rough-turned and faced and have a manufacturing boss provided on their dome end. From their shipping containers they are passed to an elevated receiving conveyor leading to a ten-station Motch and Merryweather transfer machine, Fig. 1, for their first in-plant operations.

At the head of the machine the pistons slide down a chute *A* (dome face down) leading to an orienting station where the wrist-pin holes are automatically aligned crosswise to the direction of travel. A hydraulic cylinder, arranged like an arbor press, is located at the second station *B*. The ram comes down and contacts the back face of the dome, clamping the piston against a small platen. A rotating spindle is then raised from below the table to center-drill the dome boss.

Locating and clamping of the piston along the rest of the machine is done in a different way. One pin enters both wrist-pin holes from the rear of the machine. After completing its forward travel it moves downward slightly to apply clamping pressure to the pistons. When the piston is secured in this way at the third station *C* a milling cutter is brought into play. It machines the top of both weight bosses within the skirt to a predetermined dimension for manufacturing purposes.

A transfer shuttle advances the piston to the fourth station where two wrist-pin oil holes are spot-drilled in the weight bosses. Two holes, of larger diameter than is specified for the oil holes, are drilled part way through the bosses at the fifth station and are reamed at the sixth station. These shallow, oversize holes are put in for manufacturing purposes only and will be used as drive points for the piston in a subsequent operation on an eight-spindle turning machine.

After transfer to Station 7 the two small-diameter oil holes are drilled on the same center as the drive holes. These drills pass completely through the weight bosses, breaking through one wall of the wrist-pin bores. The holes are drilled through the opposite side of the boss at the next station.

It is important that these holes be completely through and not blocked in any way so that, during engine operation, an adequate supply of lubricating oil will reach the moving wrist-pin. The holes are checked at the ninth station by two probes *D*, Fig. 2, that are lowered into them.

Should downward travel of either probe be arrested, the entire machine would shut down.

Jutting out from the end of the transfer machine is an unloading turret E that may be called the tenth station. When the probes have been raised and the combination locating and clamping pins retracted, a pair of gripping fingers F, carried by the unloading turret, picks the piston from the ninth station. While the turret is turning toward the rear of the machine, the gripping fingers rotate through a full 360 degrees to dump out the coolant and chips that have collected within the piston skirt. At the back of the machine the gripping fingers open, dropping the piston (still skirt up) into an unloading chute G that leads to a moving-belt conveyor.

Further Machining Along Falcon Piston Line

Pistons leaving the transfer machine travel along an elevated centralized belt conveyor that delivers them to a bank of two eight-spindle, Acme-Gridley turning machines. One can be seen in Fig. 3. The pistons are diverted from the main belt and directed into one of the two loading chutes. As they leave the belt the domes ride up on an inclined rod that causes the parts to tip over, thus dropping them in such a position that they will roll down the loading chute.

A motor-driven orienting device is provided on the last section of the loading chute H. This device is used to agitate the work-pieces slightly and keep them moving steadily toward the machine in the proper radial position. Once a piston arrives in the work area it is nested on the spindle carrier, dome face out. Drive-pins within the nest engage the two large holes drilled in the weight bosses, while a center on the tool carrier engages the center-drilled hole in the dome boss.

As the piston indexes from station to station, all three ring grooves—two upper compression rings and one lower oil-control ring—are rough- and finished-turned and chamfered. The ring land diameters are turned to a tolerance of plus or minus 0.002 inch and the dome is finish-faced (with the exception of the boss). To bring the piston to the proper over-all length a small facing cut is taken across the bottom of the skirt. All cutting tools used in this operation are carbide-tipped, except for the grooving tools, which are solid carbide. Upon leaving the turning machines the pistons are spot checked. Sheffield Precisionaire gages (Fig. 4) are used to check the ring grooves for taper, width, and waviness.

Edges of the skirt are smoothed and chamfered on the six-station Hammond belt-grinding machine shown in the heading illustration. Pistons roll down an inclined chute from the main elevated conveyor and come to rest in front of an air-actuated pusher rod at the loading station (within the perforated metal cage). This forces the piston, dome first, into a hollow cylindrical chuck. Friction gripping is accomplished by a ring of rubber rollers that bear on the outer surface of the piston.

Although it is a six-station machine there are only three work-heads. Each is set up with a

Fig. 1. Ten-station transfer machine marks the beginning of the Falcon piston line. In their travel along this machine the pistons are center-drilled (B), milled (C), and oil holes are drilled, counterdrilled, and reamed.

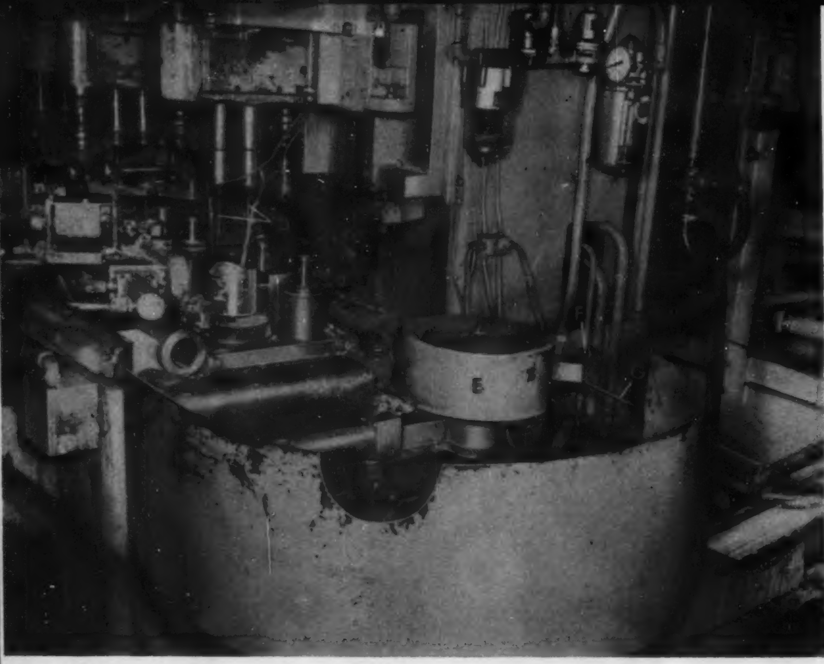


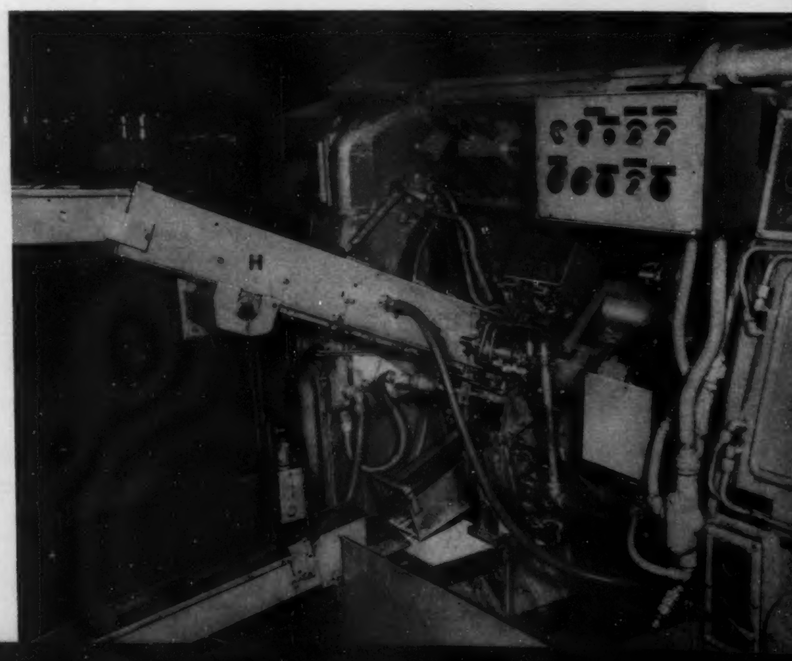
Fig. 2. Probes (D) enter the oil holes at the ninth station to be sure that they have been drilled completely through the weight bosses. Unloading turret (E) transfers the pistons from the probing position to a chute (G) behind the machine.

cloth-backed, 1 1/2-inch-wide, 100-grit abrasive belt. As a chuck is indexed to one of these positions it begins to rotate and, at the same time, the moving abrasive belt contacts the edge of the piston skirt. This same cycle is repeated at the other two work-heads. When the chuck arrives at the unloading station, which can be seen just to the left of the down chute, an air cylinder and arm strike a plunger protruding from the rear of the chuck, ejecting the piston onto a feeder conveyor.

Slots are cut through the bottom of the oil-control ring groove at opposite sides of the piston to allow oil to pass through the skirt. To do this, the pistons are directed to a Sundstrand dial type sawing machine. Loading is manual, but unloading is automatic. Spring-loaded fingers enter the wrist-pin holes to grip the parts as they are fed between two opposed vertical spindles. Each spindle carries a 7-inch-diameter, 0.090-inch-thick, carbide-tipped saw blade operating at 1200 rpm. As the parts approach the unloading station the gripping fingers release and the base of the fixture rides along an inclined cam surface, causing the base to pivot up and allowing the piston to slide clear of the machine.

Next in line for the pistons are two Ex-Cell-O boring and turning machines attended by one operator. The parts are deflected from the main conveyor and pass down a chute (foreground, Fig. 5), around a "U" turn (right), and are delivered to an orienting station *J*. A photoelectric cell is used at this position to determine when the wrist-pin holes are properly aligned. Although

Fig. 3. Second stop along the line is one of two eight-spindle automatic turning machines. Both inserted- and solid-carbide tools face the dome, cut the ring grooves, and perform rough- and finish-turning.



these holes are in line with each other, they are offset with relation to the piston center line by about 1/16 inch. Therefore, when the holes are lined up with the electric eye, which is offset by the same 1/16 inch, the pistons can be oriented in only one position. Pistons are turned for alignment by means of an air cylinder *K*. The bottom end of the actuating rod contacts the inside of the piston and an arm attached to the opposite end of the rod is swung around, thus turning the work-piece.

A shuttle bar moves the single pistons from beneath the air cylinder to a waiting station. When three pistons are waiting side by side a second shuttle engages them and positions them in front of three spindles at a boring station. One of these spindles can be seen at the extreme left. Multiple cutting tools are used on each spindle to rough- and semifinish-bore the wrist-pin holes in all three pistons in one pass.

Two more shuttle movements bring the group of three pistons beneath three side-by-side heads in the turning area. The first head is denoted by the letter *L* in Fig. 6. A "cat head" on the bottom of each spindle carries a single-point carbide tool that rotates around the outside of the piston and machines the skirt only.

The skirt is not machined in a perfect circle, but rather in an oval shape with a drop of 0.011 inch from high to low points. This is accomplished by having the three spindle heads mounted at a small angle from a true vertical position, as can be noticed in the illustration, yet having the entire tool-slide (which carries the three heads) feed up and down in a movement perpendicular to the piston faces. There is also a cam arrangement in the heads that shifts the tools slightly on the upstroke to yield a taper of 0.0005 to 0.002 inch along the skirt. As the pistons leave the machine they stop at a blow-off station where they are inverted to drain out the coolant. They are then hit with an air blast which removes all loose chips and residual coolant.

Final metal cutting on the pistons takes place on the Morris weighing machine shown in Fig. 7. The parts enter the machine from the left, skirt up, and stop at an air blow-off station where any chips that might give a false weight reading are removed. They are then moved to the next station

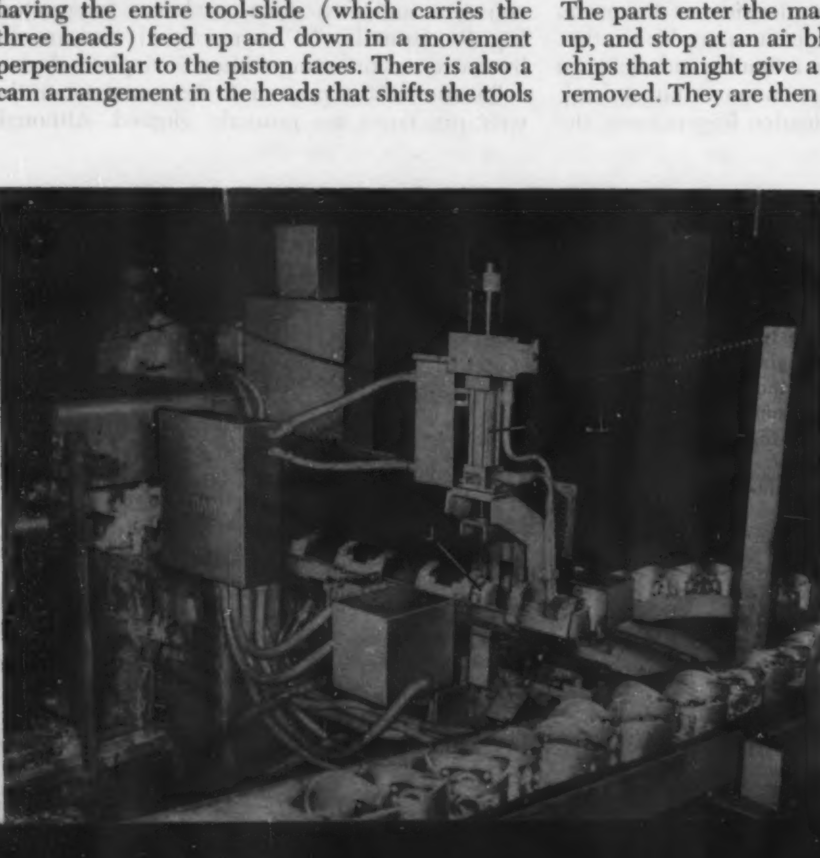


Fig. 4. (Above) After leaving the turning machines the pistons are brought to this table for spot checking. Air gages are used to check ring grooves for taper, width, and waviness.

Fig. 5. (Left) Pistons entering a boring and turning machine are oriented by a photoelectric cell at position (J). Groups of three are then transferred to a bank of three spindles (one can be seen at extreme left) where wrist-pin holes are bored.

—*M*, Fig. 8—by a long dog carried on a transfer bar. Here, orientation is accomplished by a pin that passes through both wrist-pin holes.

A flip-over arm deposits the piston, skirt down, at position *N*, from which it is shuttled to the table *O* of a Shadograph unit. The Shadograph notes the total dead-weight value of the piston and feeds the necessary information via an electronic memory circuit to the next station (not shown). At that position a milling cutter is elevated from beneath the piston, stops at a predetermined depth of cut, and removes the proper amount of metal from the two weight lugs. At the same time, another cutter feeds down on top of the piston and mills off the center boss that had been left on the dome.

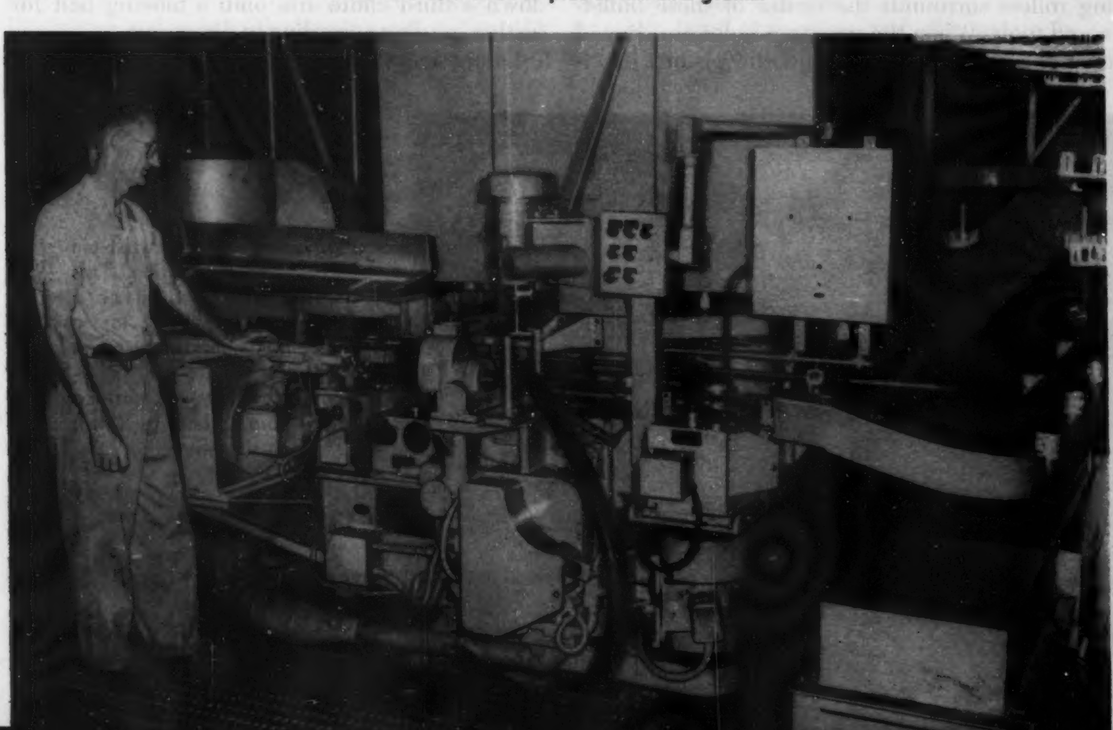
A second Shadograph at the end of the machine checks the piston for its correct weight of 500 grams, plus or minus 2 grams. If the part does not fall within this tolerance the machine is automatically shut down.

Plating Precedes Bearing-izing, Sorting, and Assembling

All pistons are plated after machining operations have been completed. Supported on racks carried by overhead conveyors, they are passed through a series of tanks for cleaning, rinsing, and

Fig. 6. When the wrist-pin holes have been bored, the same three pistons are advanced to a three-spindle turning station (L). Here the skirts are turned to an oval shape of 0.011 inch with a taper of 0.002 inch.

Fig. 7. Automatic machine in which metal is removed from within the piston skirts to bring them to their proper weight. A nominal weight of 500 grams is held to a tolerance of plus or minus 2 grams.



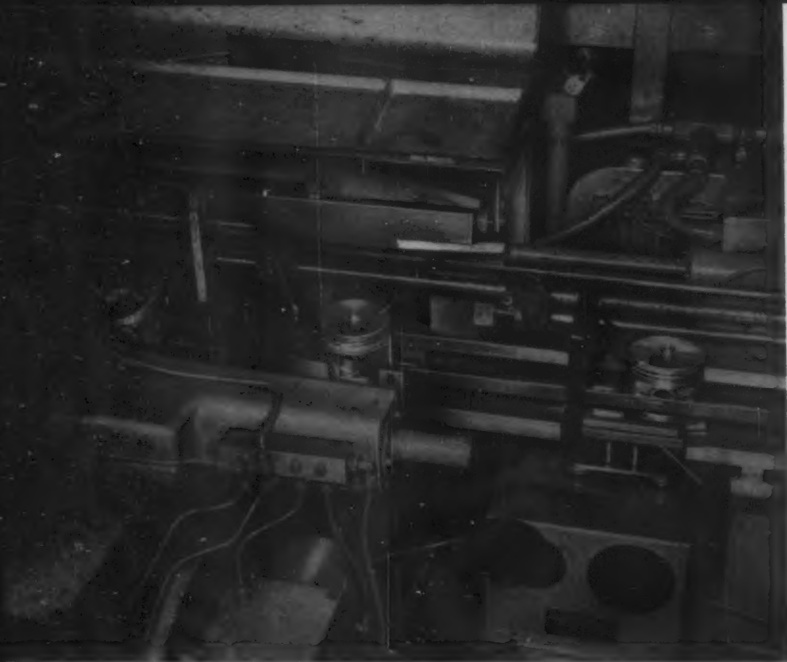


Fig. 8. One piston is being oriented at (M) on the weighing machine. Another is resting on a scale platform at (O), after which it will be milled to the proper weight and the dome boss removed.

tin plating. When the desired thickness of tin has been built up, the racks travel through a Newcomb-Detroit overhead drier, then through an overhead cooling chamber in which the temperature of the parts is brought down to approximately 70 degrees F. This last step is important as the pistons pass directly from the cooling chamber into a constant-temperature room for further work.

Within the room are two piston lines, one for six-cylinder Falcon engines and one for eight-cylinder engines. At the head of these lines are machines manufactured by the Hole Engineering Service (Fig. 9) whose spindles drive Cogsdill Bearing-izing tools. A ring of cam-actuated peening rollers surrounds the center of these bullet-nosed tools. When the wrist-pin holes are slipped over the end of the tool and the pistons hand-stroked over the roller area, the hammer-like blows imparted by the rollers size the bores and improve their surface finish.

Upon leaving these machines the pistons are carried on a narrow conveyor belt through one of two Selectrol installations where they are graded by weight based on a tolerance of plus or minus 2 grams. Depending on the weight recorded at the scale section of the machine, a pair of guide fences are actuated to direct the piston down one of three chutes. If underweight, they are passed off the main line and scrapped. If overweight, they are led away from the main line and into another area, after which they will be reworked. Pistons falling within the tolerance range slide down a third chute and onto a moving belt for further grading according to dimension.

Dimensional grading is done on a Sheffield Pre-

Fig. 9. Bearing-izing wrist-pin bores after tin plating. This is done at the head of a piston-grading line in a constant-temperature room. Small needle rollers surrounding the tool peen the surface of the bore to improve finish and size the hole.

cisionaire unit at the gaging station shown in Fig. 10. One man lifts a piston from the conveyor belt, visually inspects it for nicks and flaws, and then positions it in the gaging fixture. A second man operates the gage and notes the readings. Checks are made for pin-bore size, skirt diameter, and skirt taper. The second man also marks the piston according to which of three pin-bore size groups and eight skirt-diameter groups it happens to fall into. Group codes are marked on the dome with layout fluid. This being done, they are returned to the belt for delivery to roller type storage racks where they are laid away according to skirt size.

In a separate line within a constant-temperature room at another location, wrist-pins are also gaged, marked with the same grading code as were the piston bores, then stored. This line is linked with the engine assembly area by a Tel Autograph system, and by means of it workers on the line are kept informed of the piston grades in greatest demand. According to demand as noted on the Tel Autograph receiver, pistons of the skirt grades most needed are pulled from the storage rack. Likewise, according to the pin-bore grades marked on each of these parts, wrist-pins of the proper size grades are hand-fitted to them.

One of the last assembly operations performed on the pistons—excluding the addition of compression and oil-control rings and final assembly in the engine proper—is the joining of piston, wrist-pin, and connecting-rod. In the Falcon engine the pin is sweated into the connecting-rod but is free to pivot in the pin bores.

Connecting-rod ends are brought to a temperature of 450 degrees F. on the Tocco induction-heating unit shown in the foreground in Fig. 11. They are placed at the left-hand end of a moving chain carrier, and by the time they reach the right-hand end they are at proper heat. Assembly with the wrist-pin and piston (which are at room temperature) is done on the Denison Multipress in the background.

After the assemblies have cooled they undergo 100 per cent inspection on a second Denison Multipress. A load of 1800 psi is applied to one end of the pins (the other end being free) to check for looseness. If any movement occurs between the pin and the connecting-rod, a red warning light flashes on and the assembly is pulled from the line for possible reworking.

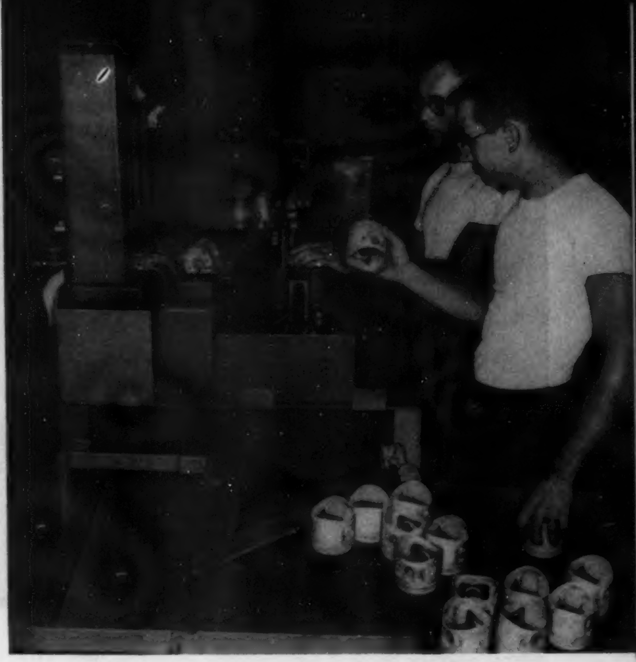


Fig. 10. Further down the line, but still in the constant-temperature room, pistons are air-gaged for pin-bore size and skirt diameter and taper. They are marked with grading codes for pin-bore size and skirt diameter.

Fig. 11. Assembly of connecting-rods, wrist-pins, and pistons. The small end of the connecting-rod is induction-heated to 450 degrees F. (foreground), then joined with a room-temperature pin and piston on a small hydraulic press (background).

Heavy-Gage Stampings Produced in Fully Mechanized Setups

Blanks are loaded automatically and practically all unloading of stampings is accomplished by air-operated swinging-arm or horizontal extractors. Belts or walking-beam conveyors carry the stampings from press to press

HERBERT CHASE

PRODUCTION of bumper parts for passenger cars and trucks at the Chevrolet Spring & Bumper Plant, Livonia, Mich., involves the use of equipment that ranks high among the major installations for this type of work in the automotive industry. As most of the parts are quite large and made of heavy-gage steel, high-capacity presses are needed for blanking, drawing, trimming, piercing, and flanging operations. Mechanized handling is applied extensively in the interest of economy.

Each of the major parts, or pair of parts, is produced on its own production line. One line of presses produces the front bumper bar in the successive stages shown in Fig. 1, observing from right to left. The blank is 0.120 inch thick, is pre-polished on one side, phosphate-treated, and dry-lubricated. This pre-treatment helps to avoid scratches in handling. Also, it is not necessary to lubricate the dies and, therefore, cleaning of the bumper parts before plating is considerably simplified. The pre-polishing and reduced scratching minimize wheel polishing of the finished parts.

Loading of the first press of each production line is accomplished mechanically. Stacks of

blanks are set below a mechanized loader, which includes a carriage having vacuum lifting cups. These cups are lowered to pick up the top sheet from the stack and are then elevated to a point where the ends of the sheet come into line with the compressed-air jets. If more than one blank should be picked up at a time, the jets of air will separate the blanks so that double loading of the press is prevented, the lower sheet dropping back on the stack.

When the loaded carriage is advanced in time with the press cycle, the blank is dropped on rollers that carry it into place on the die of a 2500-ton, double-acting draw press. Verson presses are installed exclusively in the lines to be described. The blank advances to a stop which locates it lengthwise. It is positioned sideways by guides. In the meantime, the loading carriage returns to its starting position to pick up the next blank. This drawing press makes six working strokes a minute.

The die is of a double design and forms two pieces from each blank. When the die opens at the end of the operation, Sahlin Iron Hands equipped with gripper jaws on swinging arms, as seen in Fig. 2, move in and pull the double workpiece out of the die. These hands turn the drawn parts over and release them on a conveyor belt that carries the parts to the next press. The operator of that machine flips each stamping on rollers, from which it is picked up by a walking-beam type of loader. This loader moves each piece into the die of an 800-ton press that performs the trimming operation. The press is tripped to start the operation, the movement of the loader being synchronized with the press motions.

A walking-beam conveyor, Fig. 3, transfers the trimmed parts to a 700-ton press where dies cam-form the ends of the double stamping and shear it into right- and left-hand parts. The parts are unloaded by a walking beam and placed on diverging belt conveyors that feed the parts to two 700-ton presses for reflanging operations.

The presses are hand-loaded but removal of the stampings from the dies is accomplished by Sahlin unloaders of the type seen in Fig. 4, the extractor jaws of which move in a horizontal path instead of swinging in an arc. With this horizontal type of work unloader, somewhat closer press space is possible than with the swinging type. Die clearance can be more restricted and less lifting distance is required. The extractors need only one gripper and require little space. Their over-all lengths exceed the 49-inch stroke by only 18 inches. The stampings drop on belt conveyors which advance them to two 400-ton presses whose dies are also loaded by hand.

On these presses five holes are pierced in the bottom face and side walls, after which a horizontal extractor removes the stamping and places it on a belt conveyor for transfer to another 400-ton press. Here, dies trim a 36-inch-long edge and cam-pierce several holes. Horizontal extractors again unload the work from the dies and place the stampings on belts for delivery to the final presses of the line.

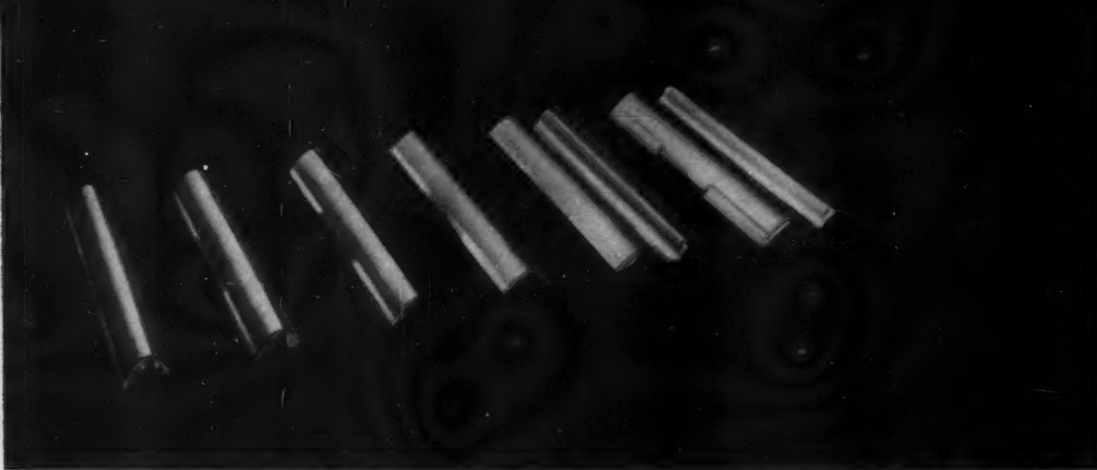
Fig. 1. (Opposite page) Successive stages in the production of Chevrolet front bumper bars from flat sheets such as seen at the right.

Fig. 2. (Right) Swinging type Sahlin Iron Hands such as here illustrated are employed on a number of presses for removing the stampings from the dies.

Fig. 3. (Right) Walking-beam type of conveyor which advances bumper stampings into a press that shears each stamping into right- and left-hand parts.

Fig. 4. (Left) On some presses a Sahlin Iron Hand that moves back and forth in a horizontal path removes workpieces from the dies.

Fig. 5. (Right) Another press operation in which an Iron Hand moves horizontally in a straight line and also in an angular path for removing a bumper part from the dies.



These 150-ton presses are of the gap type. They are hand loaded, but are unloaded by a horizontal extractor, which is unusual in gap press setups. The extractors of these presses are operated not only with the usual reciprocating motion, but with an angular movement also. The angular movement serves to bring the part toward the front of the press after which the reciprocating motion shifts the part to one side. Then the jaws open, permitting the part to drop, as seen in Fig. 5. The part is deflected to a belt conveyor.

Production of rear center bars for passenger car bumpers, shown in successive stages in Fig. 6, follows a somewhat similar procedure to the front bumper bars. Again a suction-cup blank-holder is provided for the drawing press, which is of 1950 tons capacity. This press is unloaded by a double-jaw Iron Hand, shown in Fig. 7, the part being dropped on a conveyor. A trimming operation follows, which is performed by a 400-ton press equipped with a cam die that shears the ends of the part at angles of 45 degrees. Unloading of the work to a belt conveyor is accomplished by a swinging type of Iron Hand.

A second 400-ton press is hand loaded for flanging the ends of the part and cutting the stampings across the center so that there are two stampings to be unloaded. This is accomplished by means of a swinging Iron Hand equipped with two jaws, one for each stamping. Conveyor belts carry the bumper halves to a third 400-ton press.

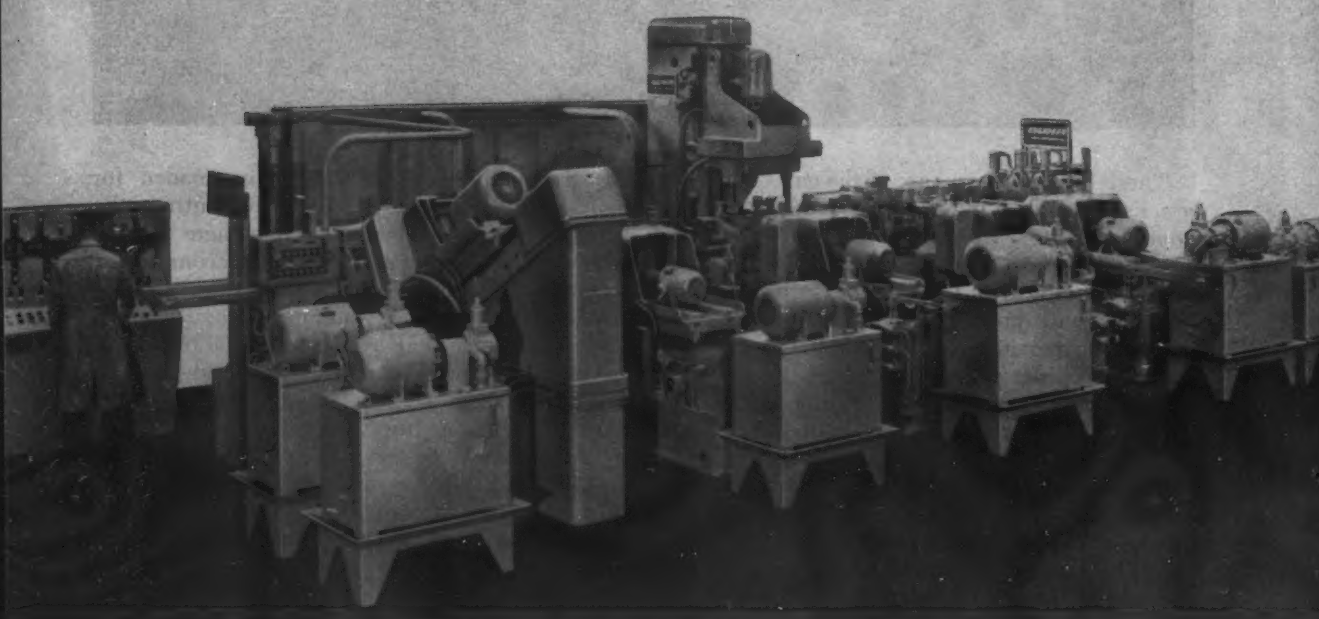
The die in this press flanges a long edge of the part, after which the piece is withdrawn from the die by a swinging Iron Hand. This press runs at twice the speed of the previous machines as it must handle twice as many pieces in the same time. Again the stampings are released to a belt conveyor, which carries them to the final press of the line. Here a cam die pierces both ends of the stamping. An Iron Hand releases the part to a belt for delivery to the plating department.

Presses in the first portion of both lines here described operate at about the same rate so that work pile-ups between presses are avoided. After the stampings are cut into two parts, lighter presses are used and operated at higher speeds. The mechanical unloading provisions help to keep the presses in step with each other.

Fig. 6. (Above) Rear center bars for Chevrolet bumpers are produced in successive operations as here shown from a flat blank such as seen at the right.

Fig. 7. (Right) Two-jaw Iron Hand which removes the double rear center bar from the drawing press, which is the first press of production line.

Transfer Machining of Aluminum Cylinder Heads for Compact-Car Engines



Increased use of die-cast aluminum automotive parts has introduced interesting problems in the design of production machine tools. Here are details on the design of a transfer machine for aluminum cylinder heads used on one of the new compact-car engines

AN OUTSTANDING feature of one of America's new compact cars is an air-cooled, six-cylinder, horizontally opposed rear engine made largely of aluminum. Wide application of die-cast aluminum parts in this engine, as well as in other automotive components, has presented some interesting problems in the design of production machine tools.

For an industry so used to making parts from steel or cast iron, the machining of aluminum requires an entirely new concept. For example, while lighter machines can be used for aluminum parts, full advantage should be taken of the greater machinability of aluminum. As a result of the improved cutting qualities of aluminum, production machines should still be designed "heavy" to permit high spindle speeds and feed rates, as well as deep cuts. Also, the more rapid machining possible makes it necessary to give special attention to the problem of chip disposal. The longer tool life obtainable in machining aluminum results in fewer tool changes.

Three views of the cylinder head for the air-cooled, six-cylinder, horizontally opposed engine are presented in Fig. 1. As can be seen, die-casting reproduces fine details and provides a good finish on many surfaces. This reduces the amount of machining required, and shorter transfer machines with fewer stations can be used. Also, it is possible to maintain closer tolerances with greater ease and consistency when machining such aluminum die-castings.

Die-casting permits the use of thinner internal walls in the cylinder head. This, together with the fine details and the lower inherent rigidity of the

aluminum alloy, puts added emphasis on the need for proper fixturing to avoid distortion due to clamping pressure. In addition to providing adequate clamping without distortion of the part, the fixtures must permit free access by, and to, the cutting tools.

Many of the holes that had to be drilled from the solid in previous designs of cylinder heads are now produced by coring during casting. However, care must be taken to see that these holes have actually been produced, and that they are accurate with regard to size and location. Some of the holes are only cored part way through the castings because of their depth in relation to their diameter, but even this reduces the amount of material that has to be removed by the cutting tools.

Smaller over-all dimensions of the die-cast, aluminum cylinder head make it possible to decrease the length of the transfer machine required, since the indexing distance between successive stations is shorter. However, adequate room must be allowed between the stations to facilitate changing the tools and performing necessary maintenance operations.

Although it would have been possible to use newly designed, special machining heads and feeding units (or lighter, standard ones) it was decided to use standard, heavy-duty components. This makes it possible to use the interchangeable heads and units at some future retooling date for machining materials other than aluminum—such as cast iron or steel.

Machining from all four sides of the die-cast, aluminum cylinder heads is performed on the Buhr Economatic seen in the heading illustration. This in-line transfer machine is 36 feet long and includes seventeen working and idle stations. Castings are manually loaded at the first station, Fig. 2, and two push-buttons are pressed simultaneously to start the completely automatic cycle. A notch in the guard (seen immediately above the cylinder head) insures correct orientation of the work-piece as it is placed on the first station locators.

Cylinder heads are indexed lengthwise through the first thirteen stations by a conventional, rotating type transfer bar having pusher fingers. At Station 14, Fig. 3, the heads are rotated through an angle of 90

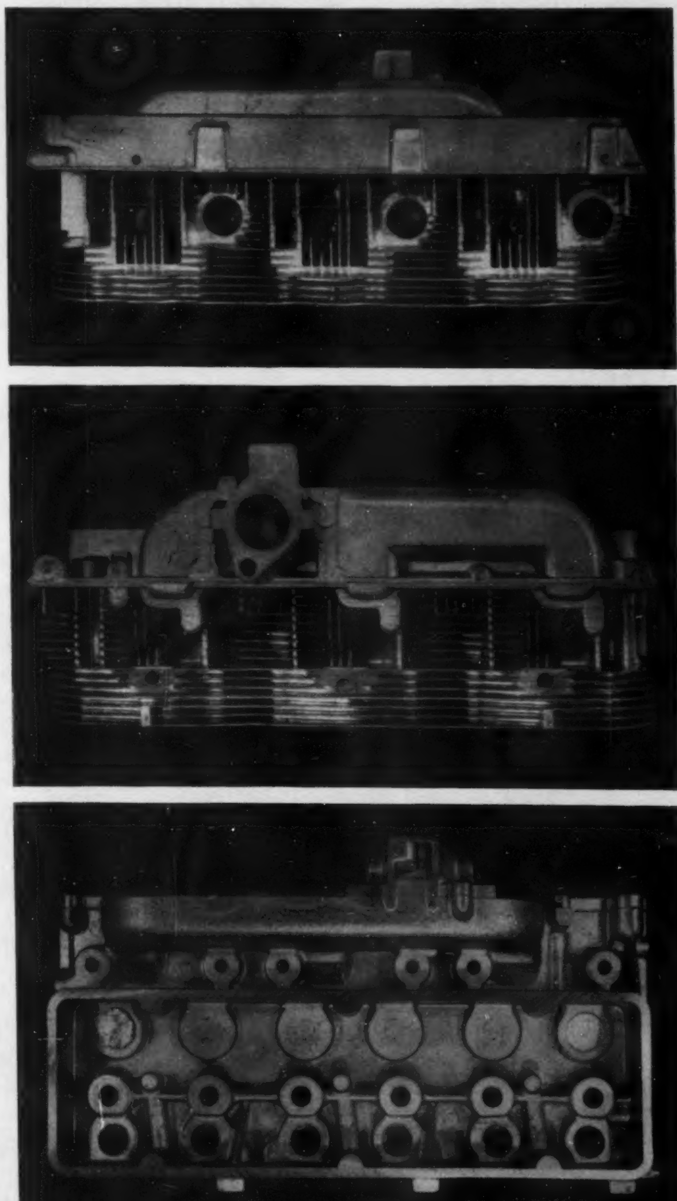
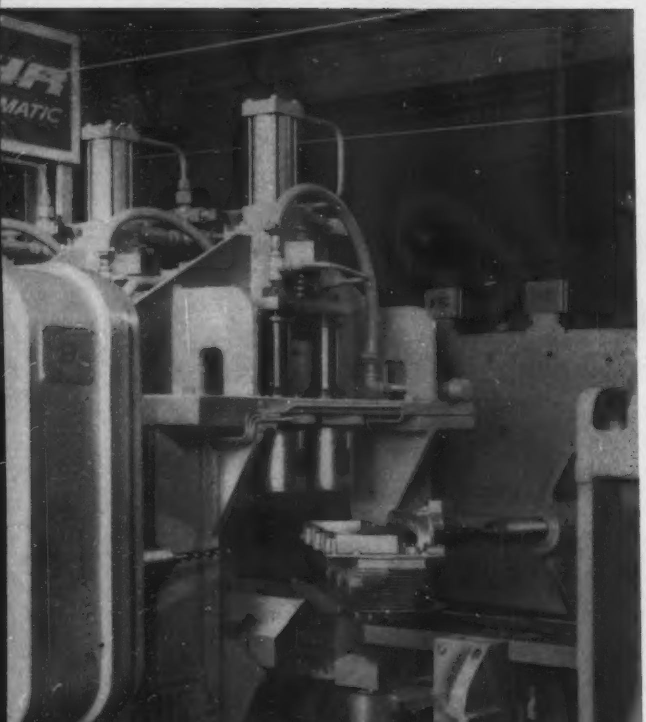


Fig. 1. Die-cast, aluminum cylinder head for air-cooled, six-cylinder, horizontally opposed engines used in a new compact car.

Fig. 2. (Right) Loading end of the transfer machine shown in heading illustration. Castings must be loaded correctly to clear notch in guard.

Fig. 3. (Below) Turntable arrangement at fourteenth station rotates heads 90 degrees so that subsequent operations can be performed on other two sides.



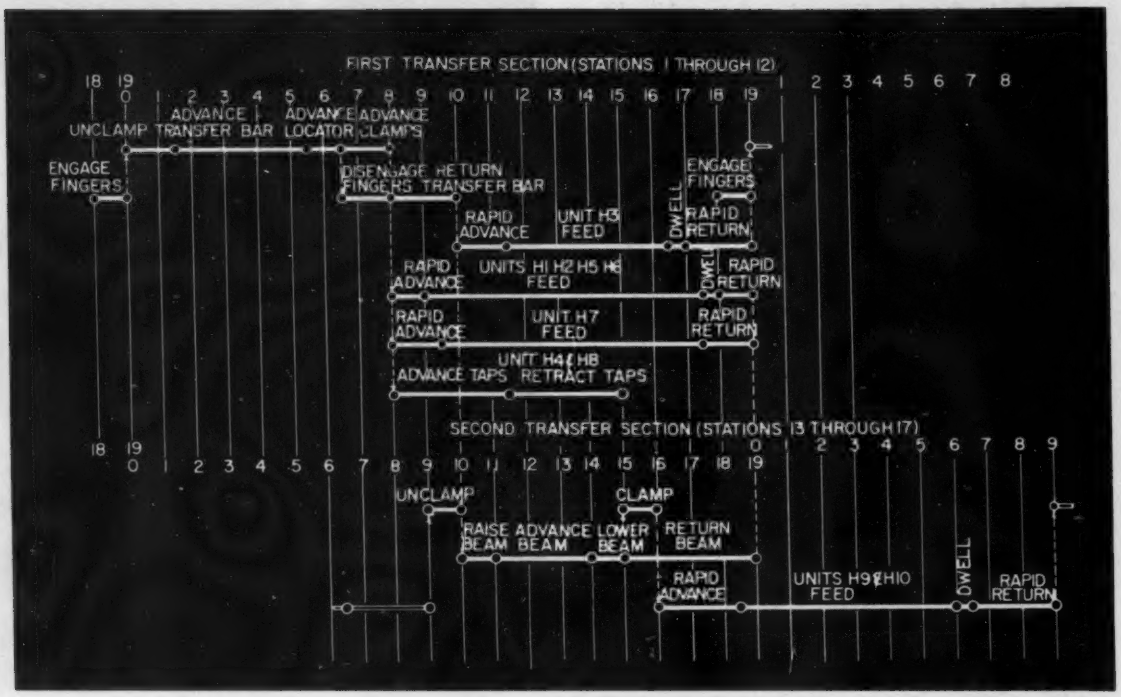
degrees, and deposited on a walking-beam-type transfer unit for indexing through the remaining three stations. The indexing distance in the first section of the transfer machine is 24 inches, and in the final section, 16 inches.

At all machining stations, coolant is applied in sufficient quantity to wash away the fine aluminum chips before they have a chance to adhere to the machine surfaces. Also, coolant guards are designed into the machine for maximum protection of the operating personnel.

The die-cast, aluminum cylinder heads are located and supported from the bottom and clamped from the top at each station. This arrangement prevents the cutting tools from interfering with the locating and clamping members and provides access for easy tool changing and maintenance. The fixtures were designed to distribute the clamping pressure over as much area as possible—using the sturdy wall sections of the castings whenever practical—to prevent distortion.

All of the tools used on this machine are designed specifically for cutting aluminum at the recommended speeds and feeds. Major differences between these tools and those used to machine cast iron are the "fast spirals" and the highly polished flutes used on the twist drills—such as those seen in Fig. 3.

Because of the possibility of dropped or broken



cores in die-casting the heads, drills are fed through most of the cored holes to insure that they have been produced. This "drilling of air" is justified because the cycle time of the transfer machine is not lengthened, and the need for 100 per cent inspection of the parts before finishing or tapping is eliminated. Tool wear and maintenance at such stations are, of course, negligible. In some locations on the cylinder head, the design of the casting die precludes core troubles. This is usually the case with large, noncritical holes such as the exhaust ports. On these holes only rough- and finish-reaming are required, prior drilling being unnecessary.

Fig. 4. (Above) Time-cycle diagram showing sequence of functions performed in both the first and second sections of the transfer machine. The figures show time in seconds.

Fig. 5. (Right) Main console of machine is shown at left. Auxiliary console at right is used for manual operation and in setting up the machine.

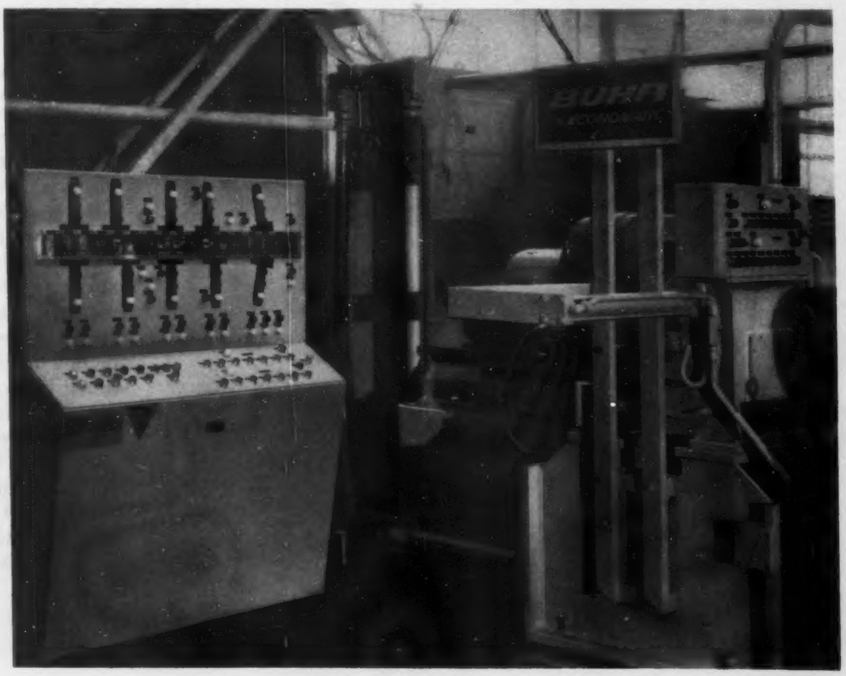
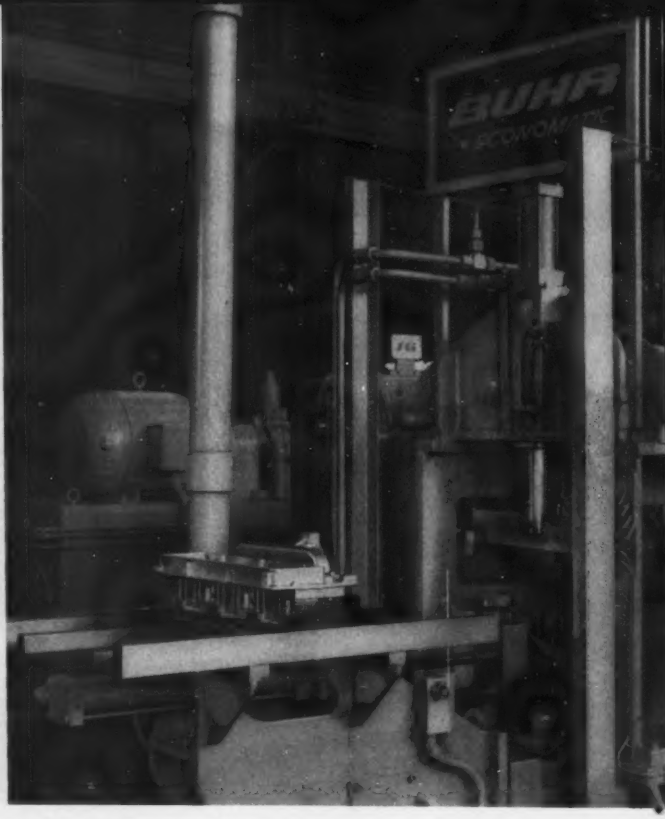


Fig. 6. At the unloading end of the machine finished heads are transferred onto a conveyor that carries them to the next operation.



Control of the transfer machine is simple. Electromechanical units are used throughout, with power for the machine movements supplied hydraulically. The controls for the two sections of the machines are integrated so that the continuous flow of the work-pieces is not interrupted. As soon as the transfer bar in the first section of the machine has been advanced and fully returned, the locators and clamps in the second section retract. Then the walking beam rises, advances, lowers, and returns. With the beam advanced and lowered, the locators and clamps engage the cylinder heads. While the beam returns, the machining units are rapidly advanced and start to feed. The sequence of functions is given in the time-cycle diagram, Fig. 4.

All machine movements during the automatic cycle can be monitored by watching lights on the operator's console, seen at the left in Fig. 5. During manual operation, as well as while setting up the machine, all movements can be controlled from the console or individually at each station. An auxiliary console, shown at the right, is provided at Station 1 for manual operation and is a duplicate of the main push-button console. This arrangement saves considerable time during setup by eliminating the need for the setup man to walk to and from the crossover in order to operate the manual-control buttons at the main console of the machine.

Finished cylinder heads are transferred out of the machine onto a conveyor, as seen in Fig. 6. A small flow switch (lower right) will automatically stop the machine if parts back up to the unloading position on the conveyor.

This plant technician is studying a problem presented by an automated "teaching machine" developed by the Western Design Division of U. S. Industries, Inc. Called the "Tutor," this machine can be readily adapted to industrial training programs. It not only automatically advances the student according to his ability to learn, but also indicates his progress. In operation, the student views a microfilm or motion picture image of the subject material, which is given in multiple-choice problem form, and pushes a button indicating his answer. The machine then corrects him if he is wrong and expands on the material, or advances him to the next subject if he is correct. A tape records the sequence of images viewed and the time spent in viewing each one.

Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Explore Your Order-Handling Methods

FILLING ORDERS is as important as getting them, but at first sight it is a homely task. While making the sale, attractive images of the equipment in operation are created in the customer's mind. These images only become real for him through a series of uninterrupted routine steps that lead to completion of the order. We too often forget that top performance in completing orders is not only the best tool a sales engineer can have, but the best way to reduce selling expense.

Mediocre order service may do us harm without our being aware of it. Sales managers have found that customers seldom openly complain of ordinary or even indifferent performance. They are inclined to drift away silently and buy elsewhere. When one does not receive specific complaints, it is so easy to conclude that all is well. That is why any shortcoming of your order-handling group may be lying in ambush, with possibilities for future harm.

Last fall a few complaining "knocks" aroused the suspicion of one sales manager that his order service engine was not hitting on all cylinders. He felt sure his sales engineers were alert to getting orders from new customers. He had concentrated on this with fine results. But now, his order-handling methods must come under the microscope.

The first job was to get the facts. He got some surprising jolts. The statistical records of performance were misleading. For instance, although 96 per cent of the number of orders were shipped on time, those delayed were usually for the largest and more complicated tailor-made machines. Then he found that any order shipped within two days of promised date was listed "on time," and delays in the shipment of renewal parts to be shipped with the machine were ignored.

First of all, to get customer opinion he sought the experience of fifty customers. Praise was generally lacking, and the following criticisms cropped up here and there:

1. Late delivery.
2. Errors in shipping notices.
3. Errors in billing.
4. Delay in investigating claims.
5. Delay in issuing credits.

But the most pointed complaint was that customers were not kept informed as to the progress of their orders. To be advised of delay on the promised shipping date, or even later, was particularly annoying. One customer stated: "We can forgive a late delivery now and then, but not when it occurs without warning."

The system of handling orders in all phases was investigated. The head of the order-handling division was encouraged to lift his sights by visiting customers, other machinery builders, and commercial firms. He was urged to get the advice of office-equipment suppliers and experts.

The most important job was to set up new and higher standards for order service. Salesmen build customer relationships, but total success depends upon filling orders correctly and in a way that will suit the customer best.

The next job was to introduce a fresh slant to order handling as a facet of marketing. Since orders are what factories live on, their correct completion is a necessary principle to live by. With this concept, order performance is a job which can have lots of drama. It is creative, like weaving a tapestry. Getting the sold machine to work is surely as urgent as getting a permit to supply it. The job of fulfillment concerns all the main corporate personnel. This selling of "order handling" within the organization is a vital task.

By a brief participation in order-handling activities, inspiration was given not only to those who usually handled them, but to all others concerned with order-filling performance. Correct order handling is now an important part of the sales program. "This, more than anything else, is going to make 1960 a good year for us," this sales manager concluded.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Fixture Faceplate Transferred with Work from Machine to Machine

Jose C. Sobkowiak, Jackson, Mich.

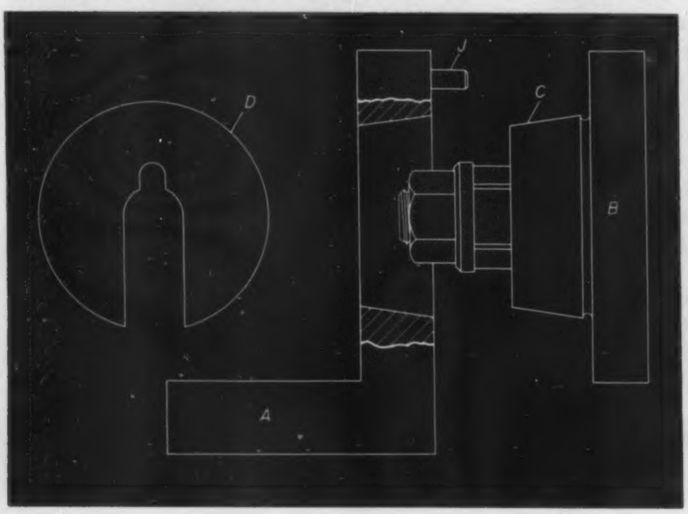
Where different machines perform a series of operations that have to be held in close relationship to each other, a system of universal two-part fixtures can be used to advantage. One of the fixtures appears in Fig. 1.

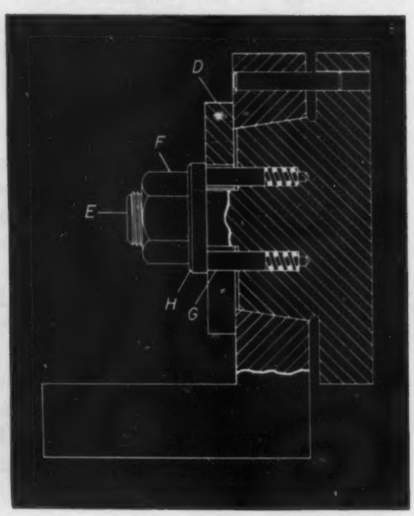
The two main parts consist of base *A* and faceplate *B*. To receive the faceplate, the vertical section of the base has a tapered hole. A short plug *C* on the faceplate proper has a reduced diameter corresponding to the tapered hole (3 1/2 inches per foot). Fig. 2 shows the base and faceplate assembled. Keeper plate *D* fits over threaded stud *E*, so that when nut *F* is tightened, the faceplate is drawn firmly to the base. Spring-loaded pins *G* keep washer *H* against the nut at all times, making it easy to position the keeper plate over the stud.

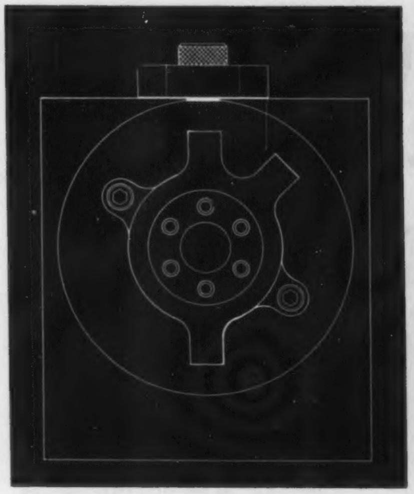
Pin *J*, Fig. 1, retained in the vertical section of the base, engages a hole of corresponding diameter in the faceplate, to provide the proper radial location for the latter member. Instead of a single hole in the faceplate, several may be provided should indexing be required. For example, the three bosses of the work-piece fastened to the faceplate in Fig. 3 have to be drilled. The back of the faceplate contains three holes at appropriate points. The faceplate is indexed in the base for drilling each boss. Also a bushing plate is added to the top of the faceplate to guide the drill.

A separate base is provided for, and attached to, the table of each machine involved in the required series of operations. The size and taper of the hole in the vertical section of these bases are, of course, identical. Likewise, a sufficient number of faceplates are provided, so that each work-

Fig. 1. (Left) The two main parts of the fixture system are a base (A) for each machine in the series of operations and a faceplate (B) for each work-piece being processed. Fig. 2. (Right) A slight rotation of nut (F) tightens or loosens keeper plate (D). Joining surfaces of base and faceplate are a fast taper, so can be readily disengaged.







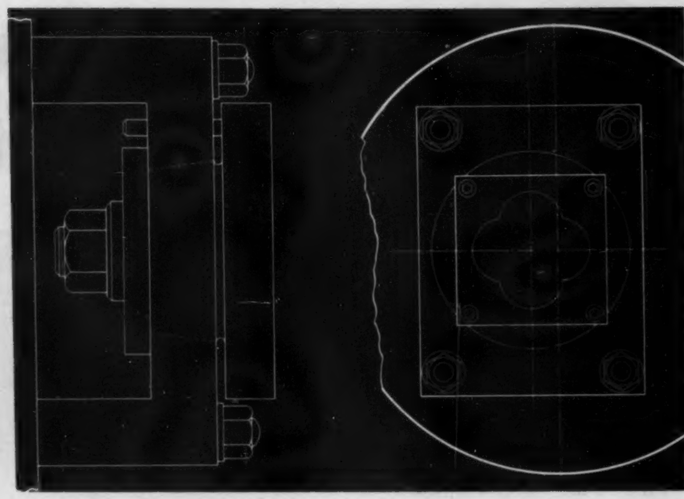


Fig. 3. (Left) The three bosses of this work-piece are aligned with the drill bushing by indexing the faceplate. Pin in vertical section of base engages holes in back of faceplate. Fig. 4. (Right) This base, used on a lathe, has a U-shape for added rigidity. Faceplate is indexed four times to complete the "clover leaf."

piece being processed can remain fastened to the same faceplate without being disturbed for the entire series of operations.

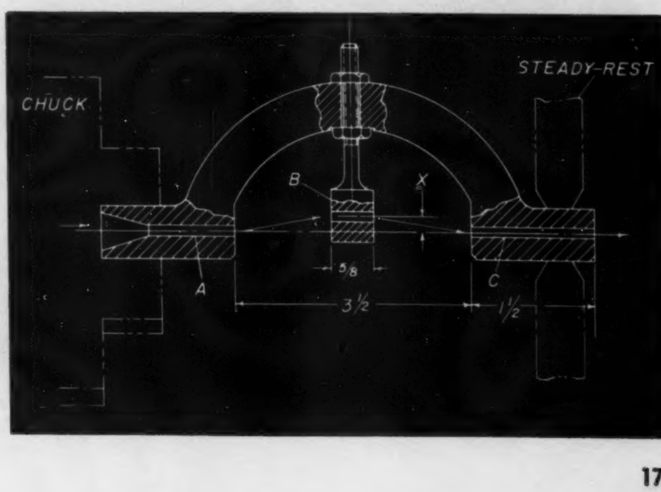
For lathe work, the base design can be modified to gain rigidity, as in Fig. 4. In the example shown, the fixture is offset from the center line of the machine to bore a "clover leaf" pattern in a work-piece.

Simple Wire-Straightening Device

Dov Jisraeli, Haifa, Israel

A lathe attachment designed to straighten coiled wire or lengths of wire that have been cut to length is here shown. One shank end of the device is mounted in the lathe chuck and the other shank end is supported in a steadyrest. The wire is threaded through the hollow headstock spindle and then through holes *A*, *B*, and *C* of the attachment.

By running the lathe at a minimum speed of 1400 rpm and pulling on the wire with a pair of pliers, clean straight wire will be drawn from hole *C*. About 1500 feet of wire can be straightened per hour. Distance X, the amount that hole *B* is offset from the center line of holes *A* and *C*, must be adjusted for differences in the hardness and diameter of wire. The attachment has been used for wire up to 3/16 inch diameter but larger diameters can be handled.



Lathe attachment used for straightening wire from coils as well as cut-off lengths of wire.

Foreign Competition Cited by Machine Tool Distributors

EUROPEAN machine tool industry was compared with its American counterpart by J. O. Ellison, president of the American Machine Tool Distributors' Association, in an address given before the Association's Thirty-Fifth Annual Meeting at the Statler-Hilton Hotel in St. Louis, Mo., on October 26. Points brought out stemmed not solely from a study of the effects of European machine tool sales in this country, but also dealt with "the progress being made there and how their industry in total compares with our own in world opinion."

J. Russell Clark, newly elected president of American Machine Tool Distributors' Association.

Referring to his recent trip to Europe, Mr. Ellison said that many of the important plants in Holland, Germany, and England "are running at, or near, capacity. Not only is their business coming from free Europe, but some of the really important orders are now, and have been for several years, coming from Russia and Red China."

He went on to say "one of the better-known builders in Germany, who has often been described as one of the big threats to the American market in general-purpose machine tools, is . . . so busy making special machinery that he could not be a factor in America if he shipped every general-purpose machine tool he is now building to this country. You cannot help but wonder, however, what would happen if that plant and others like it were to suddenly get caught up on their Iron Curtain business and really unleash their total capacity in pursuit of our market for general-purpose machine tools."

On the subject of precision manufacturing techniques so often credited to European builders, Mr. Ellison felt that this was a myth. He stated that, while touring various plants, he "did not see any instances of ultra-precision or radical departures from the techniques used here in America. . . . They go at close-limit work on pretty much the same types of machine tools and in somewhat the same way, except that they do not use the efficient material-handling equipment or operator conveniences to protect the work as it flows through the shop."

In summarizing his first impressions of the European machine tool industry, Mr. Ellison remarked "we who are distributors should not, at this time, concern ourselves solely with the subject of how many European machine tools are sold in our domestic market or with the right or

Other new officers of the AMTDA are (left to right) George E. Merryweather, first vice-president; I. B. Rabel, second vice-president; and C. D. Day, secretary-treasurer.

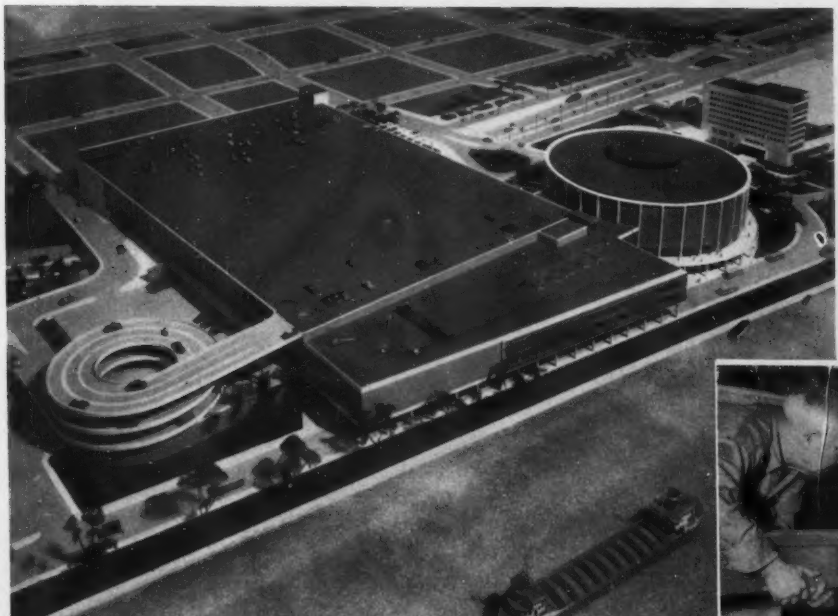
wrong of who sells them. I think we should be much more concerned with the underlying reasons why our machine tool industry is operating at a mere fraction of its capacity when our European contemporaries are enjoying a virtual boom. The causes must be of complex origin and . . . any solution that is found must, of necessity, be based upon an increased demand for machine tools in America. It appears that if the current level of demand in America is not soon stepped up substantially, and maintained at more than double the 1959 level, we shall have to become accustomed to being internationally a third rate builder and user of machine tools."

"Flame Ceramics" Produces Temperature-Resistant Coating

Exclusive patent rights to the "flame ceramics" process are lodged in the Continental Coatings Corporation, Cleveland, Ohio. Developed by the Armour Research Foundation, the process has found important applications in the diesel-, jet-, and ramjet-engine fields and in the making of silicon steel.

The process is described as follows in the United States Patent Office *Gazette* of September 15, 1959. "The method of applying an adherent refractory coating to a surface comprises injecting solid crystalline particles of an oxygen-containing material (refractory at 1200 degrees C.) into a gaseous stream being fed into a continuous flame-generating device, maintaining the flame temperature and residence time of said particles in said flame at a value to heat the particles to sintering temperature in the flame, and impinging the hot particles on the surface to form a crystalline deposit of the resulting sintered particles as an adherent coating on said surface."

While the technique of flame-spraying has been applied in the past to metals and in some instances to ceramic materials, such as refractory oxides, it is claimed that the latter have not always proved successful for various reasons. In many instances, an undesirable, glassy, amorphous coating has been deposited. The improved results obtained by the flame ceramics process are believed due, at least in part, to the recognition that the coating should retain its crystalline nature and be sintered rather than fused.



MIDWESTERN MECCA—Scale model of the Detroit Convention Exhibit Hall and Arena, scheduled for completion next fall. Fronting on the Detroit River, the $54,000,000 project covers 17 acres of land area and will provide 51 acres of usable floor space—the largest single building of its kind in the world. Meanwhile, deep in the basement, electricians are installing BullDog Electric's new XL Bustribution duct system, shown below. Take-offs at any point on the ducts will provide power for lighting exhibits and running heavy-duty machinery.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts, and

Electrolytic Cavity-Sinking Machine

The Anocut Engineering Co., Chicago, Ill., has introduced both a new process and equipment developed to speed up machining operations on the exotic high-strength metals now being used in missiles and jet engines. This process, under development for four years, utilizes the electrochemical action of an electroplating bath operating in reverse. Where electroplating adds material, the new equipment takes it off. The removal process is highly localized and concentrated. Thus, where a plating bath requires several hours to apply a metal coating of paper thickness, the new process can remove metal to a depth of 1/3 inch over a postage-stamp area in one minute. A highly polished surface finish is imparted to the work and its accuracy is comparable with that obtained by ordinary drilling and cutting.

The Anocut electrolytic cavity-sinking machine shown in Fig. 1 makes it possible to drill holes or sink cavities of any shape into metals which can scarcely be cut by ordinary metalworking tools. For example, in a test demonstration, efforts to drill a certain piece of metal with an ordinary drill produced only a shining spot after five minutes. The electrolytic cavity-sinking machine penetrated the same material at a rate of more than 1/4 inch per minute. It

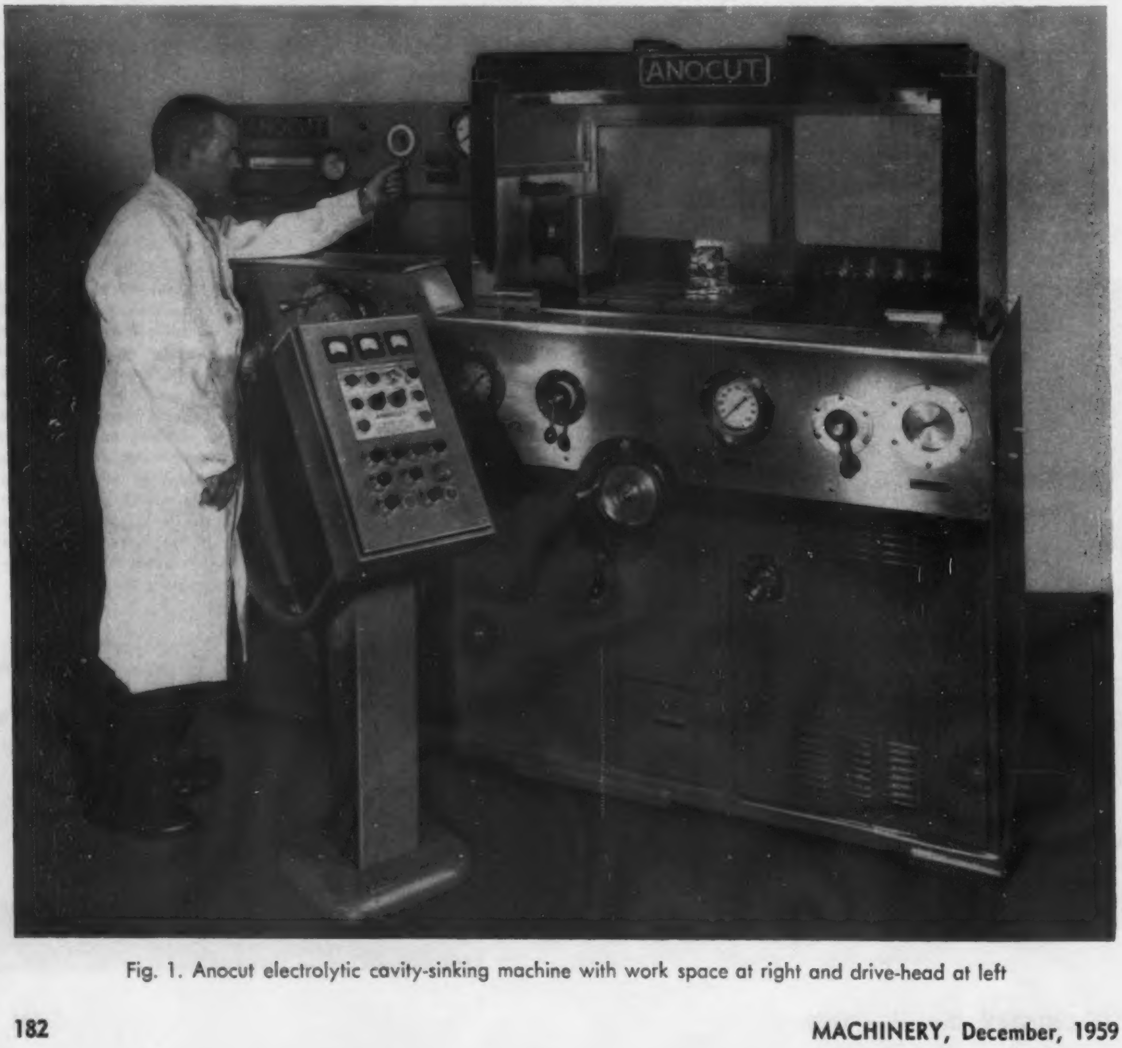


Fig. 1. Anocut electrolytic cavity-sinking machine with work space at right and drive-head at left

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

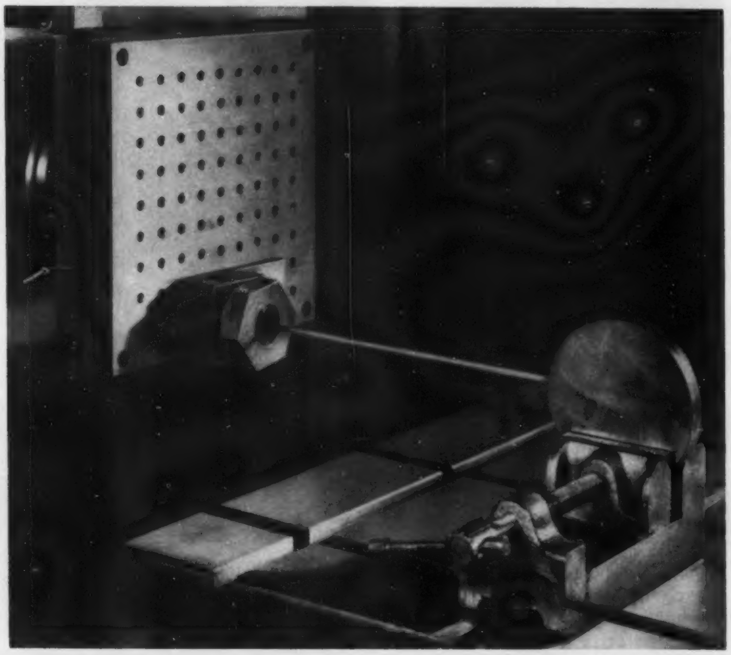


Fig. 2. Work-piece mounted in vise on the work-table of machine shown in Fig. 1, with the electrode in place on the face of the drive-ram

hexagonal hole produced with the tool (electrode) breaking through the side. The straight sides of the hole where it breaks through indicate freedom from tool erosion. The conical tip at the bottom of the cavity may be eliminated from this very tough, high-temperature alloy part if necessary. Multiple-tool electrodes mounted in a single holder as shown at the right, Fig. 4, can be used to produce a number of cavities simultaneously without reducing the penetration rate.

The Anocut equipment differs from electrodischarge machines which have been widely and successfully used in toolroom applications not only in principle of operation but also in the following respects—the metal-removal rates are many times higher; intense metal removal may be concentrated in small areas with high penetration rates; and there is no electrode wear. The nonrotating electrode is simply plunged linearly into the work material without rotation.

makes no difference whether the hole to be formed is round or square or any other shape, there is no wear on the tool, which consists simply of an electrode of the same shape as the cavity or hole to be produced.

The integrally formed turbine blades for use in rocket motors and small gas turbines, shown in the upper view, Fig. 3, are formed in a single operation on the new machine. These blades of Udimet 500 have a smooth and shiny surface. The lower view, Fig. 3, shows the results of test cuts made in zirconium-alloy material. The six round holes in the lower right corner of this piece, when measured to determine repetitive accuracy, showed a maximum dimensional variation of only 0.0005 inch.

A test specimen of Udimet 700 shown at the left, Fig. 4, has a

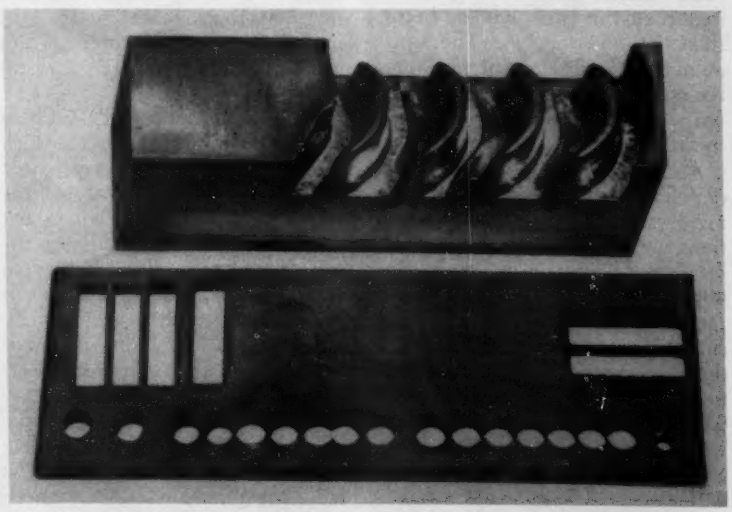


Fig. 3. (Top) Turbine blades for rocket motors and small gas turbines integrally formed in Udimet 500 material by Anocut electrolytic cavity-sinking machine. (Bottom) Test strip of zirconium alloy with holes cut to size within close limits by the machine illustrated in Fig. 1

These characteristics adapt the new equipment primarily for production applications as distinguished from toolroom use.

In the electrolytic metal-removal process, material is removed from the work-piece by passing a direct current continuously through a harmless water-base electrolyte solution between the work-piece (+) and the electrode (−). This removal process does not involve high temperatures, and there is no metallurgical damage to the work from heat. There are no sparks or arcs as in the electrodischarge process.

The rate of metal removal depends on the capacity of the power unit used and ranges from 0.030 cubic inch per minute with the Model 300 (ampere) power-supply unit to 0.300 cubic inch per minute with the Model 3000 unit. Power-supply units now in regular production include capacities of 300, 600, 1000, 1500, and 3000 amperes. Larger-capacity units with proportionately larger removal capacities can be made to order. Linear penetration rates range from 0.001 to 0.005 inch per second depending upon the type of work material, the electrode configuration, etc.

Finish varies with the work material. On most materials, it is easy to obtain a finish better than 30 to 40 micro-inches and on many materials, particularly the superalloy materials, the finish will be better than 20 micro-inches. The optimum finish is obtained at maximum removal rates, so that ordinarily only one operation is performed to make a finished piece.

Accuracy and reproducibility depend upon the kind of work involved. Under optimum conditions, accuracy within limits of better than 0.0005 inch has been obtained. Normally expected accuracy is 0.001 to 0.002 inch. The smallest-size holes and slots recommended for production applications should be not smaller than 0.050 inch in diameter or slot width. Internal-radius dimensions cannot be guaranteed to less than 0.010 inch.

During the development period of this new process, particular attention has been given to straight-wall cavities (both through holes and blind holes) on high-speed steels, high-tensile alloy steels, and superalloys of the kinds used in jet engines—Stellite 31, Rene 41, Udimet 500, Incoloy, Stellite 25, Udimet 700, etc. The process is not applicable to nonmetallic materials.

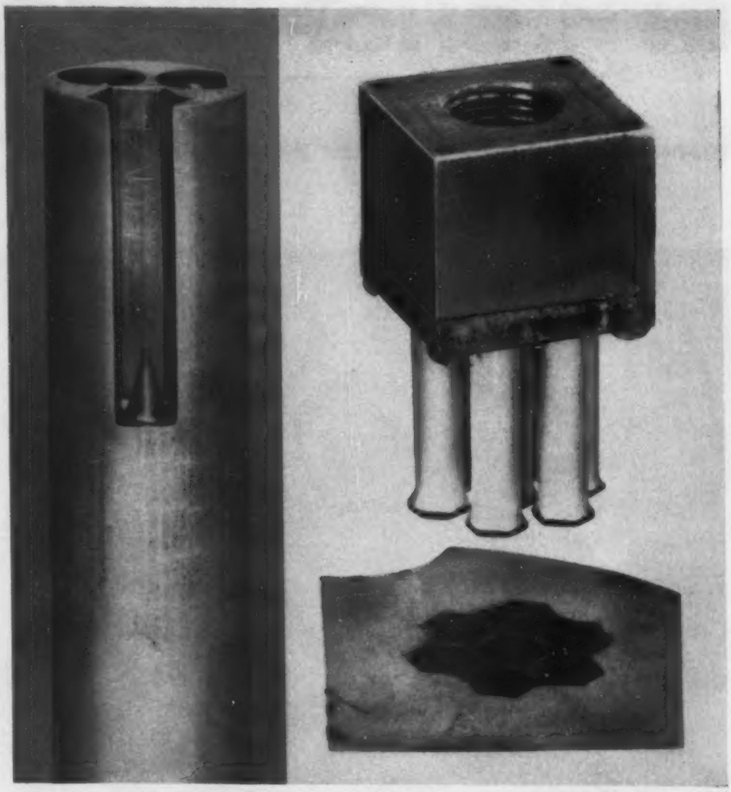


Fig. 4. (Left) Very tough high-temperature Udimet 700 alloy test piece showing hexagonal hole breaking through side produced on machine shown in Fig. 1. Straight sides of hole indicate freedom from tool erosion. (Right) Multiple-tool electrodes in single header produce a number of cavities simultaneously

The Anocut Model HCS-59 is an electrolytic cavity sinker in which the driving motion of the electrode is in a horizontal direction. All the necessary mechanical equipment and all the equipment for supplying electrolyte is included. It does not, however, include an Anocut power-supply unit or a mist collector, which are to be procured separately. The essential elements include (1) a drive-head for advancing the electrode into the work (see Fig. 2) and (2) an electrolyte-supply system including a tank, pump, and filter.

A pressure pump, filter tank, and plumbing, all of stainless-steel construction, are provided for the electrolyte-supply system. Electrical controls for the pump, electrolyte heater, etc., are conveniently mounted on a master control panel.

All of the components exposed to electrolyte are made either of stainless steel or chemical-resistant plastic. The housing for the work area is arranged for opening in front and on top and for partial opening in the rear so as to give full access for the mounting of work and electrodes. The work-table is provided with T-slots and locating keyways for mounting the work as shown in Fig. 2. An electronic detector device automatically shuts off any further feed of the electrode and also the electrolytic current supply in the event of short circuiting between the electrode and the work. All push-button controls operate at 110-volt potential. These components are moisture-proof and comply in themselves and in their wiring with the standards of the National Machine Tool Builders Association. JIC compliance is optional.

The electrical supply is three-phase, sixty-cycle; 200-volt or 440-volt to be specified by user.

The drive-head ram has a maximum horizontal stroke (left to right) of 8 inches and front-to-back adjustment by graduated handwheel of 6 inches. The working speed of the ram is infinitely variable from 0 to 0.750 inch per minute. Maximum high-speed movement of the ram for rapid traverse is 7.5 inches per minute. An 8-inch dial indicator shows the position of the ram at all times to 0.001 inch. Limit switches are provided for automatic shut-off at both ends of the ram stroke. A jog button provides for fine adjustment of ram position. An adjustable limit switch stops ram advance at any desired depth. A direct-reading tachometer facilitates speed adjustment.

The work-table is 18 by 18 inches. Usable interior dimensions of the enclosure are: height, 24 inches; length (left to right), 41 inches; and depth, 28 inches. The mounting plate for the electrode holder is 8 by 8 inches. Vertical adjustment of the work-table by graduated handwheel is 5 inches. The machine operates on 220 or 440 volts, alternating current. Total electrical energy when operating all components at full load is 10 kva. Net weight of the machine is 5500 pounds.

Circle Item 571 on postcard, page 225

"Centuramic" Centerless Grinder for Job Shop

A centerless grinder for the job shop, designed specifically for short-run work, quick and easy change-over, and operator convenience, has been brought out by the Cincinnati Milling Machine Co., Cincinnati, Ohio. This 210-6 machine is one of Cincinnati's completely new line of Centuramic centerless grinders. Furnished with a 10-hp motor, it handles work having outside diameters up to 3 inches. It has a standard wheel width of 6 inches and provision for wheels up to 8 inches in width.

Out-of-the-way location of coolant tank and hydraulic unit, in addition to toe-room recess under the machine, allows the operator to stand close to the work for dead passing or work-blade adjustment. The regulating-wheel truing attachment is inclined 20 degrees to open the throat for easy access.

Infeed adjustment wheels are available at both front and rear. All truing controls are conveniently located. The newly developed mist-control system creates a mechanical draft which prevents coolant oil from spattering the operator. The mist-collecting nozzle is automatically adjusted to compensate for wheel wear so that it constantly hugs the wheel. In addition to the 210-6 (which indicates No. 2 machine, 10-hp, 6-inch standard wheel width) centerless grinder, the Centuramic line also includes the 220-S, a production machine that will accommodate special wheels up to 10 inches wide. This line also includes the 325-12, 330-15, and 340-20 machines. The 300 series machines offer the additional economy of wide-wheel grinding.

All Centuramic grinders are fitted with Cincinnati's exclusive Filmatic spindle bearings which are self-adjusting for rough or fin-

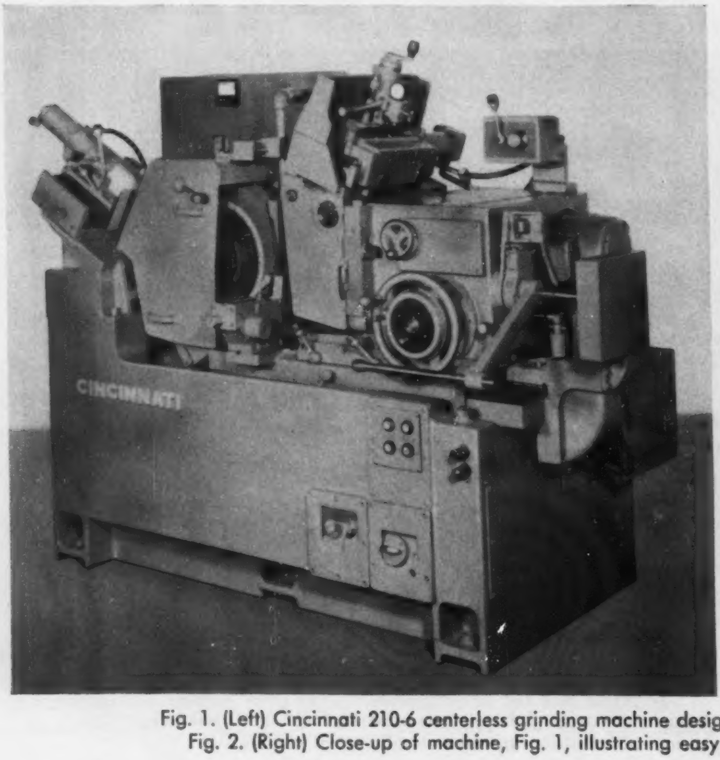


Fig. 1. (Left) Cincinnati 210-6 centerless grinding machine designed for job-shop work
Fig. 2. (Right) Close-up of machine, Fig. 1, illustrating easy adjustment feature

ished cuts and assure long life. The regulating-wheel unit has a center-mounted chain drive which places the driving force squarely between the spindle bearings and applies this force in the same direction as the work force. This feature is said to greatly minimize "pinch-out" in interrupted through-feed work.

Automatic grinding-wheel balancing, available on all machines except the 340-20, permits perfect wheel balancing in seconds with the wheel in place on the machine. Regulating-wheel speed, infinitely variable between 11 and 300 rpm, is easily adjustable by means of a handwheel and is quickly read from a tachometer.

For taper correction, a swivel-plate adjustment and clamp is conveniently located at front of machine. Corrective adjustment can be made without disturbing the alignment of work-blade, guides, and regulating wheel because the swivel plate is mounted on the machine bed and moves as a unit.

Centuramic centerless grinders are equipped with power profile-grinding wheel truing for multiple-diameter or formed wheel work and power straight-regulating wheel truing.

Circle Item 572 on postcard, page 225

Four-Way Machine for Processing Automotive Differential Carriers

A line of special four-way machines is announced by Snyder Corporation, Detroit, Mich. They perform either rough- or semifinish-boring operations in pinion and differential bearing surfaces of cast-iron automotive differential carriers. To process a part on the roughing machine seen in the illustration, the carrier is placed in a fixture in the center and clamped under hydraulic pressure. Then the machine cycle is initiated.

All four Snyder standard machining units feed boring-bars with carbide tools into the part. The pinior bore is rough-bored, counterbored, faced, and chamfered by two opposed boring-bars. A special cross-feed unit on one of the machining units enables one of the boring-bars to clear an interference point in the casting and then feed over to the correct bearing centerline location. Each of the two identical differential bearing bores are rough-bored and chamfered by opposed boring-bars having carbide tools. Production output of the roughing machine is ninety-seven pieces per hour at 100 per cent efficiency.

To semifinish a rough-bored carrier, another version of the same machine is utilized. This machine is identical to the one used for rough-boring in basic function and operation with two exceptions. After the part is clamped hydraulically, the high clamping pressure is released and hydraulic-actuated wedges hold the part in position for the semifinish-boring operation. This design reduces clamping pressures that might distort the part. A magnetic separator is included in the coolant system for this machine to assure that a high quality of surface finish is achieved. The production rate for the semifinish-boring operation is also ninety-seven pieces per hour at 100 per cent efficiency.

The machine consists of a fabricated steel three-way base with a bolted-on wing base unit. Three of the machining units are Snyder standard way building-block types. The fourth is a semistandard unit that includes the cross-feed mechanism. The units for the differential bearing bores are each powered by a 3-hp motor. One of the pinion-bore units has a 5-hp motor

Snyder special four-way machine that rough-bores, counterbores, faces, and chamfers three bearing surfaces on cast-iron automotive differential carriers

drive, while the other, a cross-feed unit, has a 7 1/2-hp motor.

Hydraulic power for the hydraulically operated, electrically controlled machine is provided by a single motorized hydraulic pump, filter, and tank unit at the side. A push-button control station is provided at the operator position.

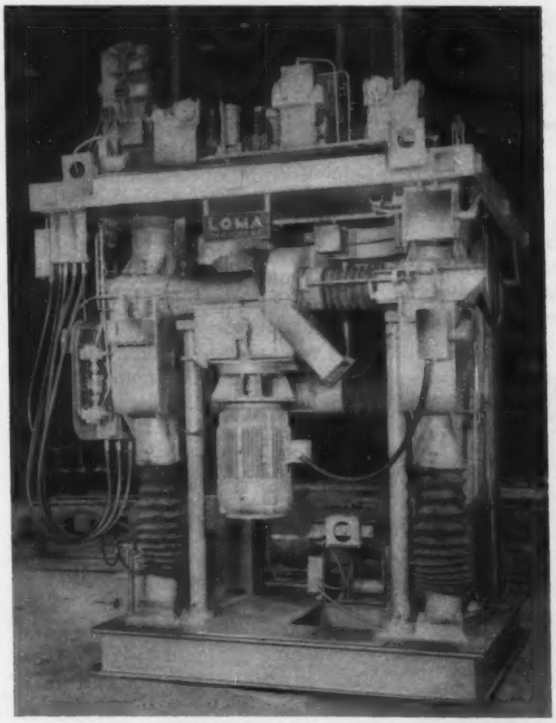
Circle Item 573 on postcard, page 225

Continuous-Casting Machine for Producing Variety of Billets, Slabs, and Shapes

The Loma Machine Mfg. Co., Inc., New York City, has announced a versatile, fully continuous casting machine of exceptionally high-production capacity. This equipment handles copper in all its various forms from phosphor-deoxidized and oxygen-free to fire-refined types. The basic design of the machine also lends itself to the casting of brasses, bronzes, aluminum, and magnesium alloys. The shapes produced include round piercing and extrusion billets, square wire bars, and rectangular slabs. The production capacity of the machine ranges from 3 tons per hour for double-strand casting of 3-inch-diameter billets to 10 tons per hour for single-strand casting of 5 1/2- by 33-inch slabs.

The equipment, Fig. 1, is usually fed with liquid metal from either an arc or induction melting furnace followed by an induction holding furnace. The molten copper at a temperature of 2150 degrees F. then flows through a special refractory-lined distributor equipped with down spouts extending into the molds. The rate of flow of the metal through the down spouts extending below the metal surface is controlled by the operator through the adjustment of needle valves. This "underpouring" method (see Fig. 2) assures a smooth, splash-free entry of clean metal into the mold cavity, thus eliminating internal porosity and inclusions in the cast material.

The billet, bar, and slab molds are of copper and are mounted at the top of the casting machine. The mold water jackets feature a special internal baffle design which greatly enhances their heat removal capacity. The cooling water initially flows through the mold jackets and then emerges from an adjustable slot at the mold bottom to impinge on the solidified metal surface in the form of a direct spray. The spray water is collected in a water box mounted below the molds and is recirculated. To prevent sticking of the cast copper to the mold and to assure a smooth metal surface, the entire mold assembly is oscillated by a reciprocating gear. The vertical stroke is only a fraction of an inch, and the rate of vibration can be adjusted up to several hundred cycles per minute by means of a variable-speed drive.



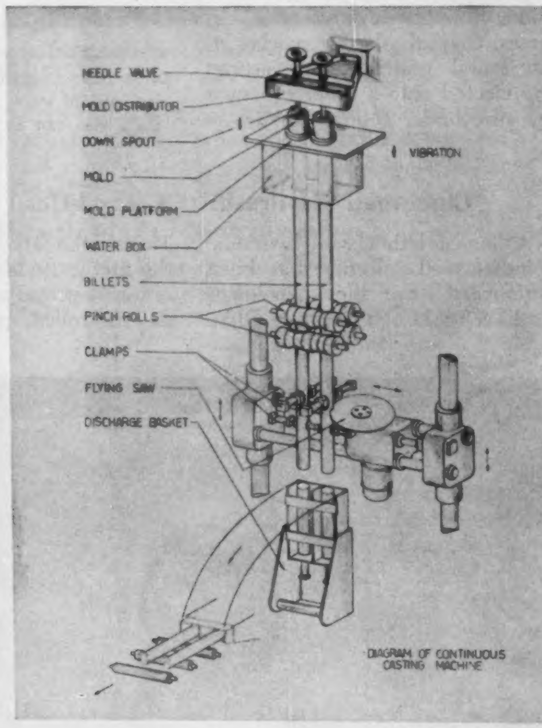


Fig. 1. (Left) Over-all view of Loma continuous-casting machine designed for the production of billets and slabs. Fig. 2. (Right) Diagram illustrating operation of Loma continuous-casting machine

The solidified metal strands are continuously withdrawn from the molds by a double set of 9-inch-diameter pinch rolls made of stainless steel. Proper clamping pressure is applied to the pinch rolls by opposed hydraulic cylin-

ders and, in addition, spring pressure is provided to hold the stock firmly in cases of power failure. The pinch rolls are driven through reduction gearing by a 5-hp direct-current motor to obtain infinitely variable casting speeds up to 60 inches per minute.

Immediately below the withdrawing rolls and mounted on a traveling carriage is the flying circular cutoff saw. During cutoff, the descending castings are engaged by hydraulically operated clamps situated on both sides of the saw blade. The entire cycle of clamping, carriage descent, saw advance, saw return, and carriage return is performed automatically. The cut billets or slabs are received in the discharge basket, which is tilted automatically by a pneumatic cylinder through an angle of 90 degrees. Once the basket reaches its horizontal position, the castings are ejected onto a roller conveyor by air-cylinder action. Finally, an air-operated stamping device applies an identification mark to one end of each casting.

Circle Item 574 on postcard, page 225

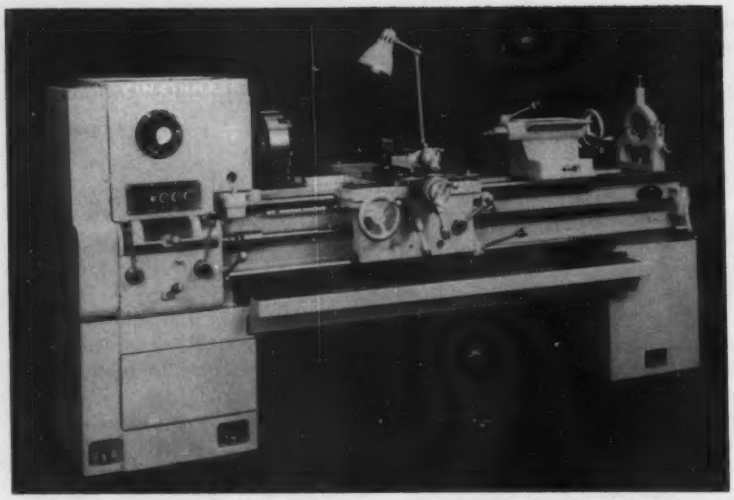


Fig. 1. "Hydrashift" geared-head lathe with power dial speed shifting announced by Cincinnati Lathe & Tool Co.

Cincinnati "Hydrashift" Geared-Head Lathes

A line of lathes with hydraulic spindle-speed selection has been announced by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. Termed the "Hydrashift," these are the first geared-head lathes in the economy-priced class to have the dial-controlled, power speed-shift feature. To change spindle speeds, the operator simply rotates the dial on the front of the headstock to the desired revolution per minute position. Hydraulic power then does the shifting automatically. Selection of any one of twelve spindle speeds is quickly accomplished by this new equipment. The convenient quick-change feed selection mechanism provides forty-eight threads and feeds.

Fig. 2. Close-up of large easy-to-read dials on the face of headstock of Cincinnati "Hydrashift" lathe

Designed to cut machine handling time to a minimum, the Hydrashift lathes include other features developed to increase their production capacities. A new super-high-speed range is offered with a top speed of 3000 rpm. This provides surface speeds suited for the latest carbide, ceramic, and other recently developed tools. The new "quick-clamp" tailstock is secured in position by a single lever, allowing very rapid tailstock positioning. Heavier compound-slides and cross-slides make possible heavier high-speed cuts.

Large, easy-reading dials for slide adjustments afford fine accuracy with greater operator speed and convenience.

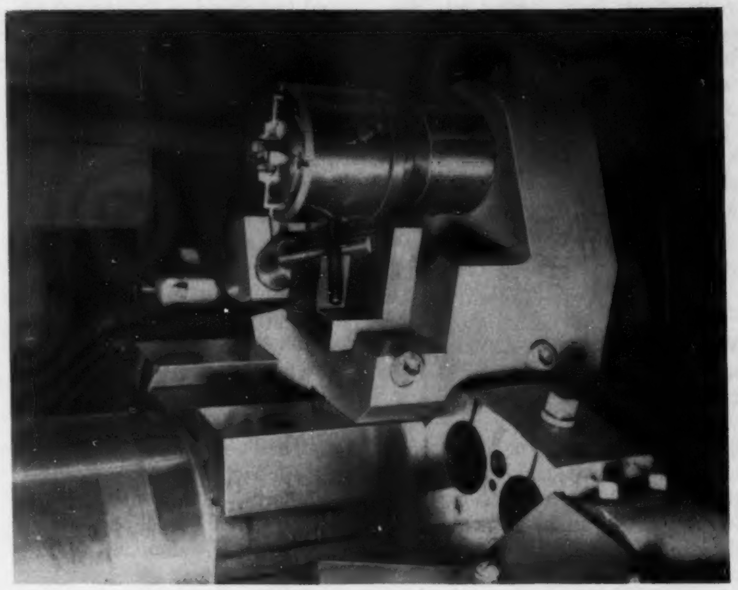
The new line of Hydrashift lathes includes 10-, 12 1/2-, 15-, and 18-inch swing sizes in a wide variety of bed lengths, and raised models for the 18-inch machine. The 15- and 18-inch sizes can also be equipped with Cincinnati Hydraguide tracers.

Circle Item 575 on postcard, page 225

Die-Head Reset Mechanism for Automatics

A hydraulic mechanism designed to reset die-heads automatically during operation of 2AB single-spindle bar automatics is announced by the Warner & Swasey Co., Cleveland, Ohio. Capable of handling die-heads up to a maximum diameter of 7 1/2 inches, this mechanism eliminates time-consuming manual resetting, and according to Warner & Swasey, is preferable to mechanical die-head reset devices with their associated tool clearance and setup problems.

The reset mechanism is powered by hydraulic oil supplied from the main reservoir of the 2AB automatic through a special "spider" distributor (for both coolant and hydraulic oil) mounted on the back of the pentagon turret. It operates automatically during the opening and closing of the machine's hydraulically actuated collet chuck. A closer cam mounted on a small hydraulic cylinder moves forward to actuate the die-head reset handle. A specially designed die-head holder is used to accommodate the cylinder and cam.



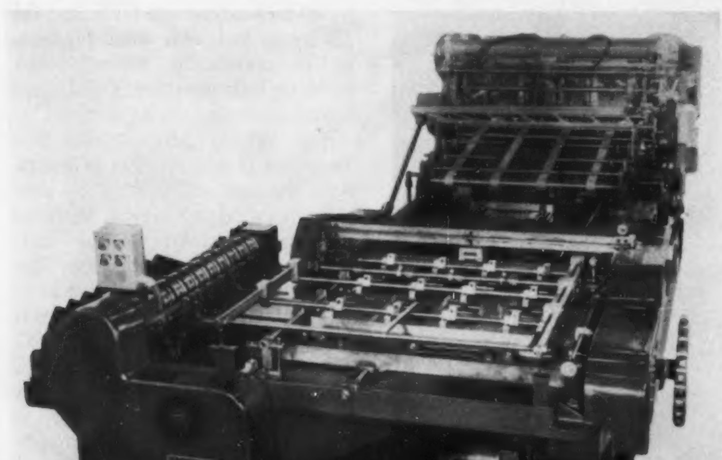
Warner & Swasey hydraulic mechanism for resetting die-heads

The unit is designed to reset Landis, Geometric, and National Acme die-heads. The special die-head holder, used to support the actuating cylinder and cam, may be employed for holding bar tools when the die-head is not needed.

Circle Item 576 on postcard, page 225

Bliss Duplex Slitting Machines

A duplex slitting machine capable of processing 44- by 44-inch sheets has been added to the line of container-making equipment manufactured by the E. W. Bliss Co., Container Machinery Division, Canton, Ohio. The unit, designated No. 5325, is available as either a squaring or body-blank slitter, and can be used for either lithographed or plain sheets. Operating speed when used as a body-blank slitter is rated at 30 to 35 sheets a minute; higher speeds are obtainable when it is used as a squaring slitter.



Duplex slitting machine announced by the E. W. Bliss Co.

The slitter consists of two units mounted on a common base and driven in unison. The first table retracts, providing ample room to grind the cutters on the second slitter and for setup. Feed-out rolls are provided on both slitters. Backup rolls for feed-out rolls on the first slitter prevent deflection and insure precise delivery of the strips to the second slitter table.

Rotating magnets working in conjunction with a mechanical hold-down mechanism provide positive separation and pick-up of the strips by the fingers on the feed chain.

The first set of slitter knives has an air-actuated sheet stop that pre-

vents sheets from getting into the cutters until advanced by the feed-bar. The second-operation slitter is protected by a shear pin and micro switch in its feed-chain drive which stops the machine if an overload should occur. Double-sheet feeding is effectively guarded against by a detector and stop located just ahead of the second slitter-cutter shafts.

Auxiliary equipment includes a Bliss electric cutter grinder that permits regrinding of cutters without removing them from the machine, and an adjustable body-blank stacking attachment.

Circle Item 577 on postcard, page 225

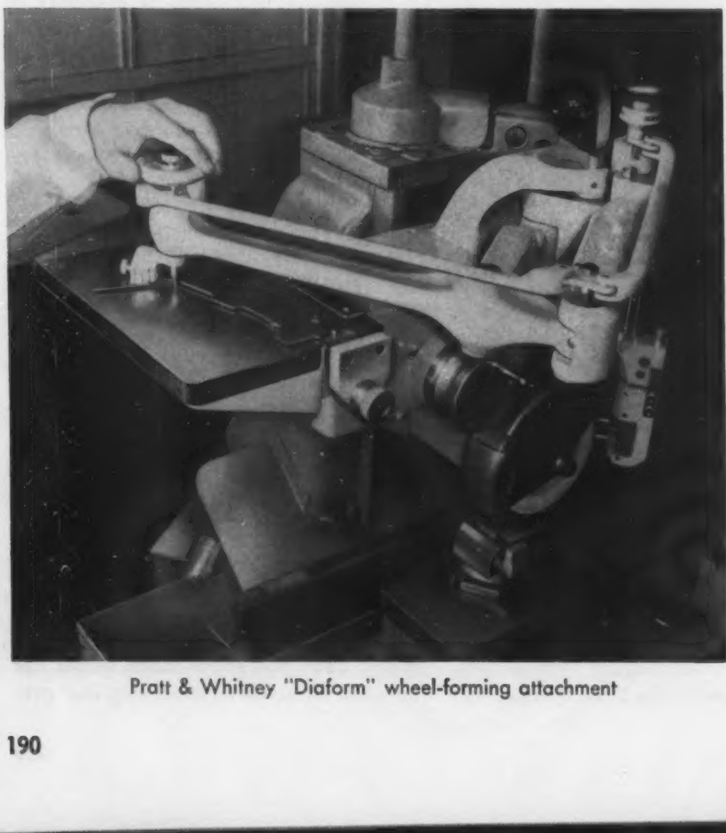
"Diaform" Wheel-Forming Attachment

The Pratt & Whitney Co., Inc., West Hartford, Conn., has announced the addition of a Model No. 5 to its line of "Diaform" wheel-forming attachments. This attachment is intended for use on toolroom surface grinders. Unlike previous Diaform attachments, which are portable, the No. 5 is designed for permanent mounting on the machine's spindle head. Mounted in this manner, the attachment is said to be instantly available whenever it is needed to form-true or re-true the grinding wheel, yet it is out of the way where it will not interfere with the form-grinding operation.

To use the Diaform attachment, the operator simply traverses a tracer over the profile of an easily made template. The tracer path is transmitted at a 5 to 1 or 10 to 1 reduction ratio to the truing diamonds which form-true the grinding wheel to the desired shape. The entire job can be performed in minutes so that the wheel is form-trued accurately to a few ten-thousandths of an inch. Like all Diaform wheel-forming attachments, the new model is equipped with a swiveling diamond spindle that is said to equalize wear and greatly increase the accurate life of the diamonds. The diamond spindle is a tandem type with two diamonds, one for semifinishing and a second for finish truing.

The new Diaform is supplied in two sizes: Model No. 5-1 for surface grinders with table working surfaces approximately 6 by 18 inches which will form-true grinding wheels up to 7 inches in diameter by 1 inch face, and Model No. 5-2 for grinders with table working surfaces of approximately 8 by 24 inches that will form-true wheels up to 10 by 2 inches.

Circle Item 578 on postcard, page 225



Pratt & Whitney "Diaform" wheel-forming attachment

Johansson radial drill with two work stations

Radial Drill with Two Work Stations

Two work stations, accessible through 360-degree rotation of the ram, are features in the line of precision radial-drilling machines recently introduced by the I. O. Johansson Co., Skokie, Ill. The 20- by 40-inch adjustable table and the 22- by 24-inch rear work platform utilize accurately ground work surfaces incorporating T-slots and coolant trough.

The sliding 3-foot radial arm moves on precision roller bearings. Both the ram and column are precision ground to permit sensitive and fast adjustment of the drill-head over each hole location. The column can be raised 12 inches to give a maximum distance from spindle to work surface of 53 inches. The unit can process a work-piece over 4 feet high and 6 feet in diameter.

Three models have drill capacities up to 1 3/4 inches in cast iron. All units incorporate direct-gear drive with positive speeds in various ranges from 45 to 3000 rpm.

Attachments are available which provide for power feed to spindle, power elevation and power locking, and for performing automatic tapping.

Circle Item 579 on postcard, page 225

Shuttle Type Machine for Processing Three Faces of Tractor Transmission Cases

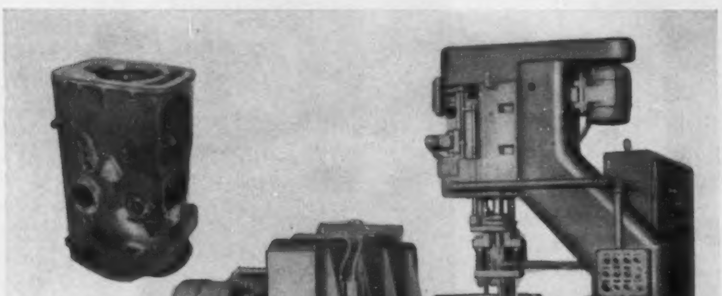
Utilizing a single fixture and a two-way shuttle mechanism, a machine recently announced by F. Jos. Lamb Co., Detroit, Mich., taps, chamfers, and reams horizontally and vertically on three faces of tractor transmission cases. The required production rate of only thirty-eight pieces per hour permits shuttling the entire fixture and part, thus saving the cost of an additional fixture and eliminating the need for more complex and costly handling, positioning, and clamping mechanisms required for higher production. Tooling costs are also held at a minimum through the use of standard taps, reamers, and chamfering tools.

This machine is comprised of basically standard components—a vertically mounted Lamb standard quill unit; an individual lead-screw tapping head mounted on the main base; and a horizontal, two-station, single-slide work-head. The part is manually loaded into the fixture, positioned on locating pins, and hydraulically clamped. Electrical interlocks prevent machine operation unless the part is properly seated and clamped.

The horizontal slide unit carries two different sets of tools and makes two working strokes. The first stroke, or pass, performs two tapping and three chamfering operations. After the fixture is shuttled, the slide unit reams three holes, the tapping head taps four holes, and the vertically mounted quill unit reams one hole simultaneously. Accurate positioning of the fixture is assured by sturdy guide bars that pass through traveling bushing plates on the horizontal slide and vertical quill unit.

Machine arrangement provides easy accessibility for tool changing, maintenance, and servicing of components. Power is supplied from a hydraulic power unit having a capacity of 10 gallons per minute. All electrical and hydraulic components conform to JIC standards. The machine operates without coolant, and the main base is equipped with chutes for convenient chip removal.

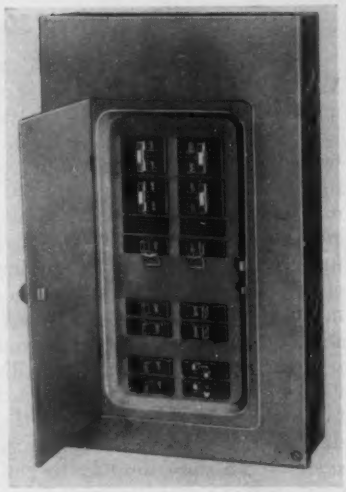
Circle Item 580 on postcard, page 225



Machine for tapping, chamfering, and reaming three faces of work-piece

Circuit-Breaker for Lighting and Appliance Circuits

Two "Twin" circuit-breaker load centers that provide a safe method of combining single- and three-phase branch circuits in the same unit have been announced by the Circuit Protective Devices Department, General Electric Co., Plainville, Conn. The devices incorporate a unique lug and single-breaker stab unit physically isolated from the main bussing. This unit is used for connecting the "wild" or "high" leg of a three-phase, four-wire delta system. Breaker-handle knockouts in the load-center front trim are so arranged that only single-handle, 240-volt G-E Type TQL breakers can be connected to the high-leg phase. This special bussing and knockout arrangement assures the proper connection of 120-volt lighting and appliance circuits to the appropriate phases, as required by the National Electrical Code, Article 210, Paragraph 2113.



G-E 100-ampere load center unit for correct application of lighting and appliance breakers

Both units are available in flush, surface, and rain-tight enclosures. One is of split-bus (parallel) design for areas where a single main disconnect is not required. This unit will accept up to five two-pole breakers (including lighting main) and one 3-pole breaker in the main section, and up to ten single-pole circuits in the lighting and appliance sub-section. The second device is a twelve-circuit main-lugs-only model. Used with Type TR "Twin" circuit-breakers, this panel accommodates up to eighteen 15- or 20 ampere single-pole branch circuits, and one three-pole circuit.

Circle Item 581 on postcard, page 225

Niagara Line of Modernized OBI Presses

The Niagara Machine & Tool Works, Buffalo, N. Y., has announced the modernization of its line of Series A inclinable open-back presses. This line continues to feature Niagara's exclusive multiple-point mechanical sleeve clutch which is especially adapted for continuous work requiring clutch engagement and disengagement at every press stroke. An outstanding feature of the improved presses in this line is the slide, with its solid casting brought forward to provide solid backing for the dies. Flat surfaces on the front and sides of the slide simplify the fitting of feed-roll lifters and other attachments. Rigid, multiple V-gibs assure accurate alignment, balanced loading, and a greater guiding surface. Additional refinements include an air-powered inclining device and split belt guard (both optional) to facilitate raising or lowering the slide and quick-adjusting friction-clamp knockout rods.

Fewer parts and simple construction are said to make the improved presses more economical and safer to operate. Built in thirteen standard sizes with shaft diameters from 1 1/4 to 6 1/2 inches, the complete line now covers a capacity range of 5 1/2 to 190 tons.

Circle Item 582 on postcard, page 225

Completely Redesigned Lines of DoALL Band Machines

Announcement by the DoALL Co., Des Plaines, Ill., of its new lines of heavy-duty Contour and Contour-matic band machines completes this company's redesign program begun one year ago. There is now an even progression of models so that each user can select band machines that will closely fit his needs. Thus unnecessary expense due to over- or under-capacity machines is eliminated. Many recently developed improvements have also been introduced to upgrade the production capacity of the machines.

The Contour-matic sawing machines (Models 1612-2, 3612-3, and 6013-3) have power-feed work-tables which distinguish them from other band machines. Both the heavy-duty Contour and the Contour-matic machines have greater band capacity, which particularly suits them for use with Demon high-speed-steel saw bands. Contour-matic machines featuring power-feed work-tables are available in four throat depths—16, 26, 36, and 60 inches. The work heights are 13 inches for the Models 2613-3 and 6013-3, and 12 inches for Models 1612-3 and 3612-3, a substantial increase over previous models. The 16- and 36-inch machines are intended for toolroom and manufacturing applications, while the 26- and 60-inch machines are intended for heavier duty. The frames of these machines are of box type, unit-welded, all-steel construction de-

Open-back inclinable press of line announced by Niagara Machine & Tool Works

DoALL Model 1612-3 Contour-matic band machine of completely redesigned line

signed to give maximum strength and rigidity. In order that the full range of saw bands may be conveniently used for internal cutting, a new type larger-capacity welder, the DBW No. 8, has been developed for these machines.

The job selector, an exclusive DoALL feature, is conveniently located at eye level. Upper access for the 36-inch models is now by means of double doors for convenience in band changing and a reduction in headroom required. The drive mechanism has been improved to give longer belt life. All Contour-matics use three-speed transmissions and infinitely variable drives. The 16- and 36-inch machines have 3-hp motors and provide band speeds of from 35 to 6000 fpm (feet per minute). The 26- and 60-inch machines have 7 1/2-hp motors and a band speed range of from 45 to 9000 fpm. Table tilt is 45 degrees right and 5 degrees left on these models.

The feed table is powered by a completely self-contained hydraulic system. Both speed and direction are conveniently controlled by one handle on the column of the machine, grouped with the other operating controls. These are arranged for easy access and natural sequence of operations. A contour attachment enables the power feed to be used for cutting radii and irregular curves.

The Contour-matics provide a choice of coolant methods. Flood coolant, air, or both, combined for mist cooling, assure fast cutting and long tool life for all materials, even at the elevated band speeds possible with a Demon band. The Contour-matic machines now use flanged steel wheels with rubber tires, which permits the high band tension needed to obtain high cutting rates.

The power tables of the Contour-matic machines are particularly useful for repetitive production work. This is due to the fact that the component of the cutting force and table-feed force is uniform, downward, and into the table. Thus, it actually holds the work firmly in place for machining.

Fixturing is sometimes required because the work cannot be held with the standard attachments; or more frequently to reduce work-handling time when the volume is very large. High-production splitting and slotting operations are typical examples. Even in these cases, fixture design can be very simple and inexpensive with a Contour-matic. T-slots in the table facilitate fixture setup.

Along with the new Contour-matic line, a companion line of heavy-duty Contour machines has also been announced—the Models 1613-2, 2613-2, 3613-2, and 6013-2. These are similar to the Contour-matics except that they do not have power-operated work-tables and circulating-coolant systems. These are available in the same 16-, 26-, 36-, and 60-inch throat sizes and are as ruggedly constructed as their equivalent Contour-matic models. All have a work height of 13 inches. Although they may be advantageously used for some production work they are intended primarily for heavy-duty contour sawing such as that encountered in toolrooms, maintenance shops, and fabrication shops. These machines, designated by the suffix "2" in their model numbers, are heavier and more rugged than the two lighter lines of contour machines that were announced earlier this year.

Circle Item 583 on postcard, page 225

Typical operation performed with Oxweld scarfing torch

Oxweld Scarfing Torch

A hand scarfing torch with a universal mixer that enables it to operate on either acetylene or fuel gas has been introduced by the Linde Co., division of Union Carbide Corporation, New York City. This Oxweld C-65 scarfing torch is equipped with a starting rod feeder that provides quicker starts and prevents the formation of "fins" by eliminating normal preheat time. It is designed for use in removing surface defects from steel ingots, billets, blooms, and slabs prior to final rolling. Nozzles designed to produce a broader low-velocity oxygen stream serve to increase the width of the area that can be scarfed in a single pass of the torch. Rod feed is actuated by the cutting oxygen lever and is easily controlled by the operator. Feeders are adjustable to permit altering the length of stroke or to compensate for wearing away of the nozzle.

Flashback is prevented by the spring-loaded floating gas mixer which assures proper proportioning of gases and enables either acetylene or fuel gas to be used without changing mixers. An automatic compensator valve minimizes the effect on the preheat flames

when the cutting-oxygen lever is depressed.

The torch is available in three lengths—36, 42, and 48 inches. Precision-cast, one-piece torch heads are easily replaced and are reinforced at wear points with a special Haynes Stellite alloy. Plastic packings provide gastight seals.

Circle Item 584 on postcard, page 225

Monarch Lathe Equipped with Numerical Control

The application of positioning controls for turning, facing, and boring to its versatile Series EE Model 1000 lathe has been announced by the Monarch Machine Tool Co., Sidney, Ohio. A conveniently located console provides numerical control through a modified General Electric Mark II unit. All of the lathe's regular control features have been retained, making it adaptable to conventional manual operations in a few seconds' time.

Input data is obtained from standard eight-channel, 1-inch wide, punched paper tape, prepared on a Flexowriter. A programmer sets up information which is punched on the tape in block form. Each block determines the exact distance the carriage must move from the zero point, as well as the exact movement of the cross-slide, for the required diameter. Feed rates, as well as spindle speeds and other auxiliary functions, are also set up. When the tape is read in the control console, the information is interpreted in the director cabinet and remains in memory until the proper carriage and cross-slide positions are obtained. Feed-back units on the carriage and cross-slide signal the director when the commanded position is reached.

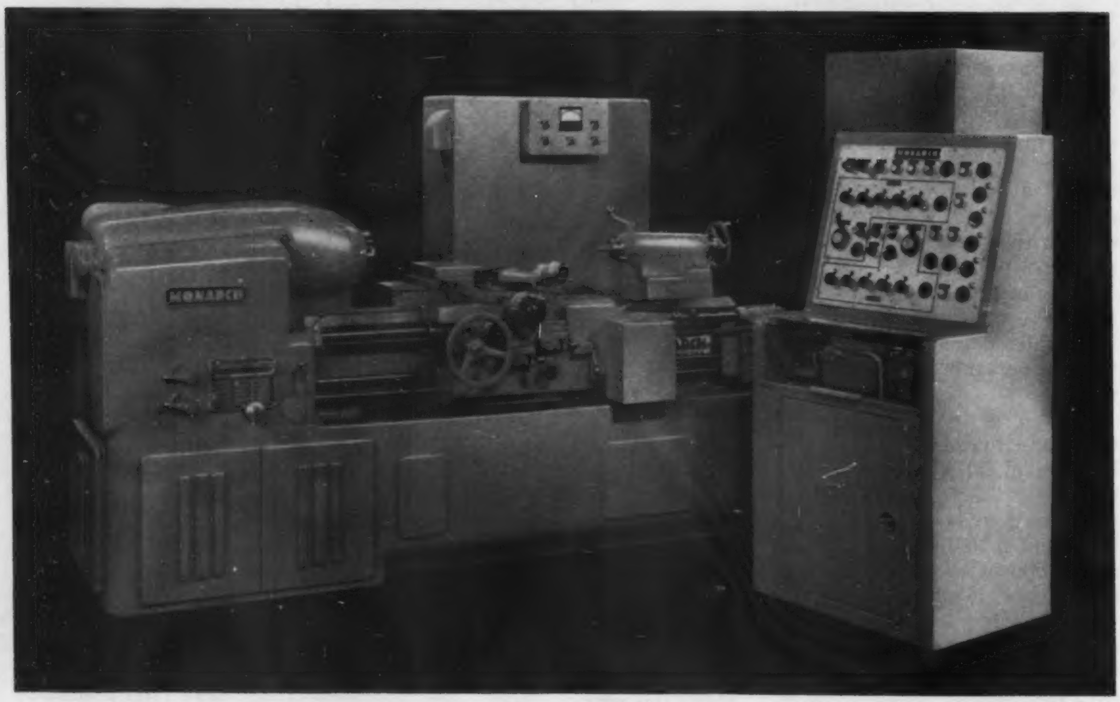
The versatility of the Series EE Model 1000 lathe makes it particularly adapted for numerical control, especially as it has four infinitely variable speed ranges which are power-selected. Tape commands can select any of these ranges and, through five manually set potentiometers that control the drive-motor speed, can select any one of five speeds for a given cycle. The infinitely variable 15-hp, direct-current main-drive motor gives speeds from 20 to 2000 rpm.

Electronically powered feed motors drive the carriage and cross-slide through gear-boxes. Each gear-box has a low- and a high-feed range, as well as a traverse range, all of which can be tape-selected. Within each one of the high- or low-feed ranges there are nine pre-selectable feed rates. These range from 0.55 inch to 6.25 inches per minute in low and from 2 to 25 inches per minute in high. Any of these eighteen feeds may be programmed. Longitudinal and cross-feed rates may be separately selected. The longitudinal-traverse rate is 150 ipm (inches per minute) and the cross-traverse rate, 75 ipm. Both gear-boxes can be disengaged for manual operation of the lathe.

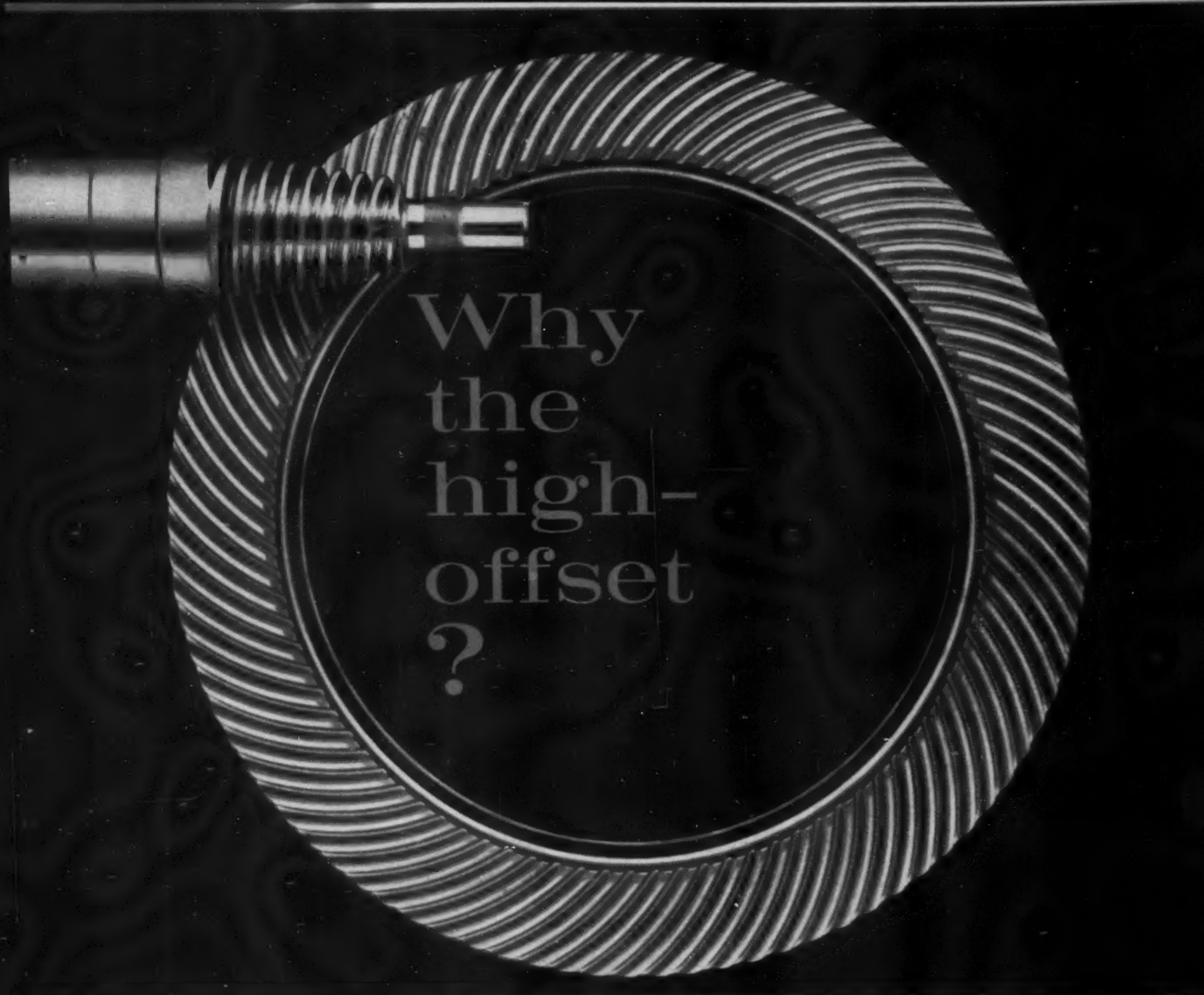
The prepared tape is turned over to the operator along with a companion data sheet. Setup is simple and quick. The data sheet gives the starting point for the cut so that the operator may position the tool in correct relation to the zero reference point. Longitudinal and cross zero positions may be shifted by appropriate knobs.

Circle Item 585 on postcard, page 225

(This section continued on page 196)



Numerical control applied to Monarch lathe



...and where can you use it profitably?

High-offset makes a difference!

It's the difference that lets you combine *high-reduction* with strength, compactness and other advantages you might find profitable in certain applications. For instance . . .

For smooth operation—as in office equipment that must run quietly—high-offset pairs provide smooth, quiet tooth action. Because the teeth "wrap around" the pinion, *you get continuous action—even with just one or two teeth.*

Where space is a problem—as in instrumentation—the high-offset lets you design a more compact unit. Choose just the offset to solve your design problem with a more flexible, more compact unit than the corresponding worm and wheel.

Where you need strength—as in farm machinery—high-offset hypoid pinions with teeth, which tend to "wrap around," are larger and stronger than corresponding bevel pinions.

High-offset or high-ratio hypoids can be cut on the same Gleason equipment that is used on more familiar spiral bevel and hypoid gears. You can also use the same testers, quenching presses and other auxiliary Gleason equipment you're using now. Grinders are available for applications requiring precision finish. For ratios of 1:10 or 1:40 or even higher.

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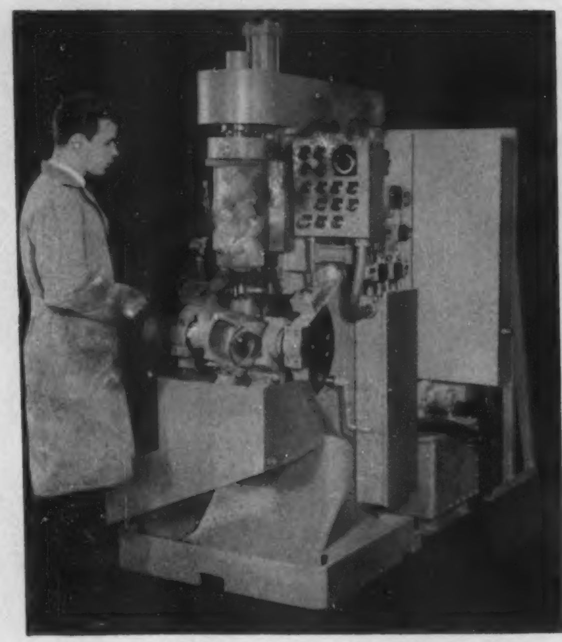


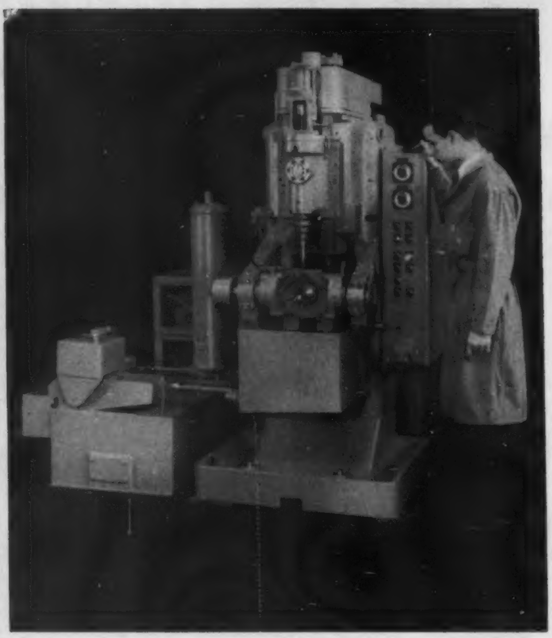


Fig. 1. (Left) Machine developed by the Micromatic Hone Corporation for accurate machining of truncated sphere such as shown at end of stud in center view, Fig. 3. Fig. 2. (Right) Single-spindle Microhoner developed to produce surface finish of 6 to 10 micro-inches on truncated sphere at upper end of stud shown at right, Fig. 3

Micromatic Machines for Processing Truncated Spherical Surfaces

The Micromatic Hone Corporation, Detroit, Mich., has developed equipment and a technique for completely machining, in two fast operations, any type of truncated sphere. The machines employed to completely process the truncated sphere at the end of a typical full ball stud such as shown at the right, Fig. 3, are shown in Figs. 1 and 2. The first step in producing the finished ball stud from a rough forging such as shown at the left, Fig. 3, is to machine the taper shank and roll the threads. The ball stud is then heat-treated (usually 30-40 Rockwell C). The spherical or ball end is then processed to accurately controlled geometric proportions and close dimensional tolerances on the machine seen in Fig. 1. Heat-treating the ball before machining and Microhoning serves to remove decarburized metal.

For machining, the ball stud is located on the taper and clamped in the thread. It is positioned on an inclined axis as shown in Fig. 1, so that the center of the ball at the crown and at the point at which the shoulder intersects the sphere are in a horizontal plane.

For the first operation, a special Micromatic cutting tool removes the bulk of excess stock. For example, on a 1 1/4-inch-diameter ball stud, approximately 0.060 inch of stock is removed from the ball in a fifteen-second, floor-to-floor cycle. This time includes automatic clamping and ejection. The generated finish is 40 to 60 micro-inches. Total error in sphericity is held to 0.0005 inch and size is controlled within 0.001 inch.

The Micromatic cutting tool has a solid body and is U-shaped at the cutting end. It utilizes two round Carboloy blades or discs. Each blade is held by a clamp, which also acts as a chip-breaker. This prevents the chips from curling back and scratching the work surface. The unique design of this tool provides for a constant cutting speed over every point on the ball.

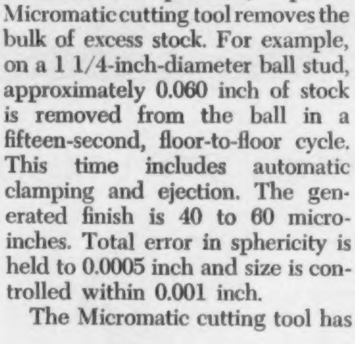


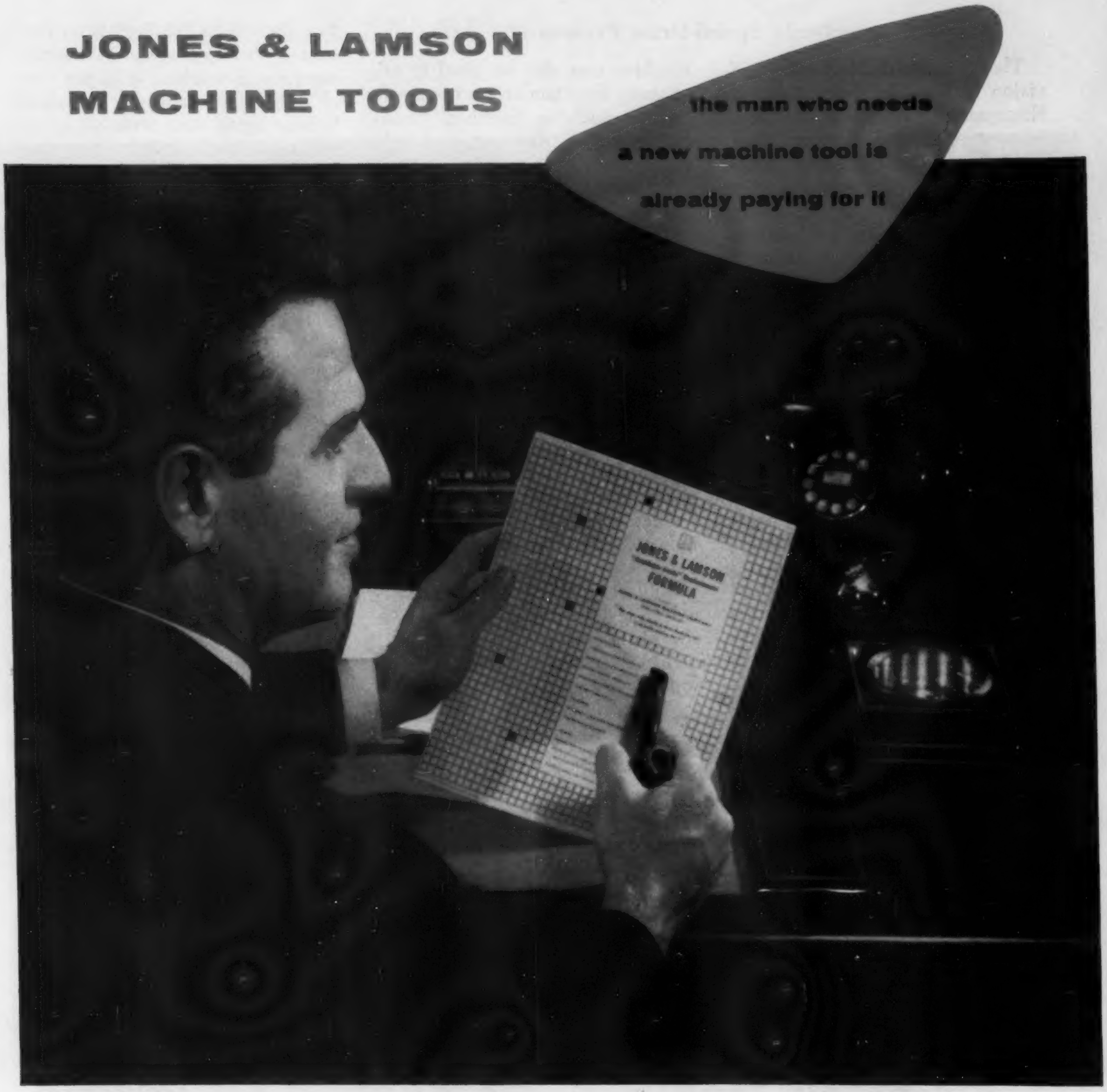
Fig. 3. (Left) Rough-forged ball stud. (Center) Stud after processing sphere on machine seen in Fig. 1. (Right) Ball stud after Microhoning end

Because only a portion of the blade is exposed to cutting action, its position can be reversed to give several usable cutting faces.

After the cutting operation, the ball (see central view, Fig. 3) is Microhoned to generate final geometric accuracy, size, and surface finish on the machine shown in Fig. 2. The part is located and held in the same manner as for the cutting operation. The combination of rotating motions of the workpiece and the special Microhoning tool results in a functional cross-hatch lay pattern and makes the abrasive self-dressing. In a twenty-four-second, floor-to-floor cycle final 0.002 inch of stock is removed to bring the ball end to size, produce finish of 6 to 10 micro-inches, and hold sphericity within 0.0003 inch.

(This section continued on page 198)

JONES & LAMSON MACHINE TOOLS



"Nearly 3000 Requests for this!"

J & L's new "Avoidable Costs" Replacement Formula answers a crying need: in recent weeks we have received nearly 3000 requests for detailed information, most of them from key production people.

This new formula contains none of the fallacies that are found in the formulas most commonly used as a basis for decisions in buying machine tools.

Using the J & L Formula, you get a realistic, reliable picture of production performance, something you can really hang your hat on. It gives you the means of proving to management the vital importance of modernizing plant equipment. And the figures you can produce are both valid and realistic, because they allow for the inflation spiral of equipment costs, as well as rising labor rates.

We'll be glad to supply you with a copy of the J & L "Avoidable Costs" Replacement Formula, together with some easy-to-use work sheets. Write today to Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

 For more data, circle this page number on inquiry card

Steelweld Speed-Draw Presses

The Steelweld Machinery Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, is now offering a line of "Steelweld Speed-Draw Presses" which have an unusual patented design developed to step up operating speed. These presses are particularly suited for deep-draw applications. They permit extra-long draws at high speeds, making it possible to reduce the number of operations required to form a part as well as permit some operations that are not usually possible on a press.

Lubrication is automatic and control is of the JIC type with motor starters and clutch control in one cabinet. The speed-draw presses are available with one-, two-, or four-point suspension and for single- and double-action operation. They will accommodate die cushions to provide blank-holding pressure for draw work. Although the slide motion is ideally suited for deep-draw work, the machine can also be used to advantage for standard press applications, such as forming, blanking, piercing, trimming, and light embossing.

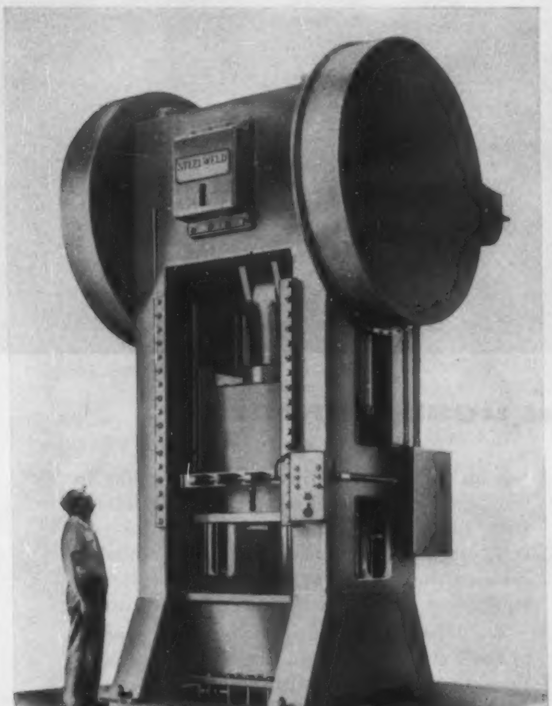
Steelweld Speed-Draw presses are available in capacities of 200 tons (based on 3/4 inch from bottom of stroke) and up. Mid-stroke capacity of machine is 50 per cent of full load capacity. Standard bolster areas start with 30 by 36 inch and standard slide areas start with 30 by 30 inch and range upward.

Circle Item 587 on postcard, page 225

Machine for Descaling Coiled Stainless-Steel Stock

A special Rotoblast machine for descaling stainless-steel coils has been manufactured by the Pangborn Corporation, Hagerstown, Md., for use in the new Coshocton, Ohio, plant of the Universal-Cyclops Steel Co. Several features designed to provide a degree of flexibility not previously available in equipment of this kind have been incorporated in the new Rotoblast machine. The equipment is designed to handle two strands of steel simultaneously. Individual-strand control permits the coils to be processed through descaling at different line speeds.

To provide additional flexibility, the position of the blast wheels can be changed at the touch of a push-button on the control panel, Fig. 1, to obtain the most effective targeting of both top and bottom blast streams for the particular widths of steel being processed. The velocity and volume of abrasive thrown are also easily variable. The Rotoblast wheels are equipped with two-speed, constant-torque motors and automatic orifice control. Either 50 hp at 1200 rpm or 75 hp at 1800 rpm can be used, depending on the type (chromium or chrome-nickel stainless) and



Single-point, single-action 200-ton Steelweld Speed-Draw press with die cushion

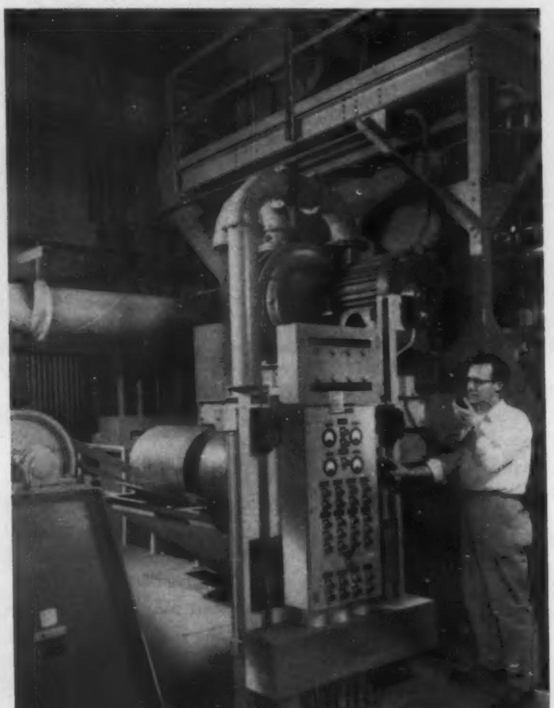


Fig. 1. Control panel of Rotoblast machine includes telephone communication to key points of line

JONES & LAMSON "AUTOMATION"

the man who needs
a new machine tool is
already paying for it

Numerical Control . . . what's it worth?

What *about* numerical control: is it all it's cracked up to be? The answer, in a word, is "yes". Here's why. With numerical control, the *big* factor is *flexibility*. Tape or numerical programming can be employed economically for medium or small lot production, even down to *single pieces*. Accuracy is also increased. For instance, Jones and Lamson tape controlled positioning units hold tolerances of ±.001 on applications for punching, drilling, boring or similar operations where point-to-point positioning is mandatory. Machine set-up and change-over become primarily an office procedure. Numerical control of machining operations eliminates the need for cams, templates, even prototype parts and special fixtures. It results in greater machine utilization, and speeds actual machining. Lead time is reduced, and because human error is largely eliminated, accuracy is improved.

Any way you look at it, numerical control has come of age. It's being used more and more, simply because it produces better, at lower costs. For detailed information, write Jones & Lamson Machine Company, Dept. 710, 512 Clinton Street, Springfield, Vermont.

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thickness of steel stock being put through the line.

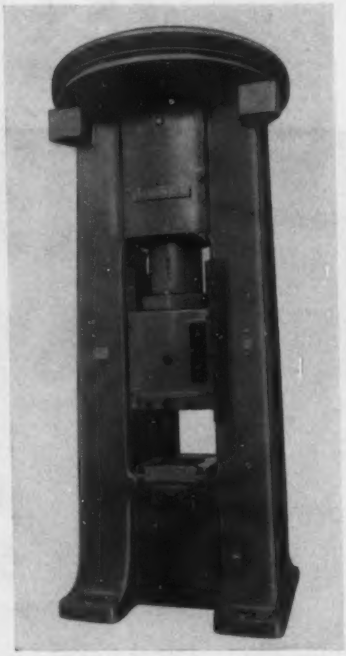
The blast descaling equipment is located approximately in the center of the user's 659-foot, fully automatic intermediate anneal and pickle line. It is designed to mechanically descale 300 and 400 series stainless coil stock 0.040 inch thick and thicker, prior to pickling. The material to be descaled is uncoiled and passed through rolling mills (for reduction), annealing furnaces, fog cooling, blast descaling, pickling (two electrolytic and one acid bath) inspection, and recoiling. As the entire processing line is continuous and automatically controlled, no "operator" is required for the Rotoblast descaler after it has been set for the exact degree of blast desired. The two strands of steel pass simultaneously through the blast machine and are continuously descaled, top and bottom, at line speeds ranging up to 80 linear feet per minute. The two strands moving simultaneously through the mechanical descaling operation, after reduction by rolling mills, annealing, and fog cooling, may be seen in Fig. 2. Since line speeds are determined by the requirements of the annealing operation, the shot-blast machine needs only four wheels for thorough descaling of both sides at the maximum speed of the processing lines. Rotoblast steel shot in sizes S-70 and S-110 is the abrasive used for the descaling operation. Effective abrasive cleaning and recycling equipment is built integrally with the machine so that the abrasive can be reused.

Circle Item 588 on postcard, page 225

Percussion Screw Presses for Metal-Forming

Weingarten percussion screw presses, introduced in this country by the Cosa Corporation, New York City, are designed for hot or cold forming of ferrous and nonferrous materials. These presses are available in many sizes with capacities ranging from 80 to 3000 tons. An outstanding feature is the infinitely variable stroke and pressure, which are easily set over a wide range by dials and scales. Two-hand controls provide maximum safety for the operator.

The novel drive mechanism produces a sharp elastic blow at the tool stage, and provides quick, automatic reversing of the ram by motor reversal. The flywheel is driven directly by a friction roller or, on larger presses, by a gear and gear-ring assembly which is flexibly connected to the flywheel. Compressed-air brakes enable the ram to be stopped and held in any position.



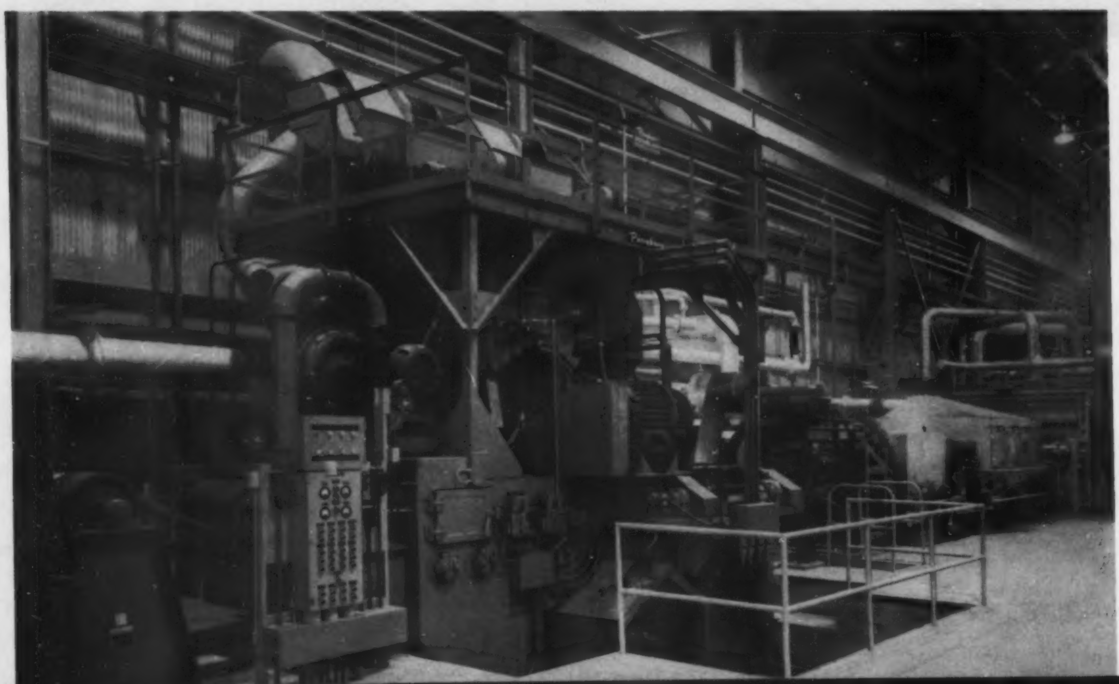
Weingarten percussion screw press

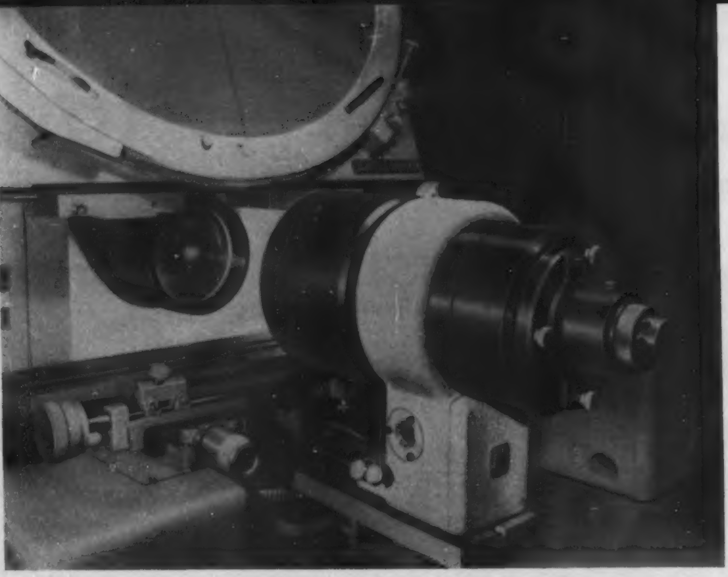
Additional equipment for these percussion screw presses includes, fall-back, or hydropneumatic ejectors, gripper feed units, and a photoelectric-beam safety device which, when broken, automatically stops operation of the press.

Circle Item 589 on postcard, page 225

(This section continued on page 202)

Fig. 2. Rotoblast descaler built by Pangborn Corporation for use in coiled stainless-steel stock processing line





Jones & Lamson 6-inch lens system for optical comparator

New Lens System for Optical Comparator

The Optical Comparator Division of Jones & Lamson Machine Co., Springfield, Vt., has announced the introduction of a five-magnification lens system with a 6-inch aperture that is free from measurable distortion. This J & L lens is especially useful in applications which require the precise measurement of large areas. It permits great latitude of use, due to its extremely sharp definition and freedom from distortion. It is easily installed in all Jones & Lamson comparators that are designed or equipped for five magnifications.

Circle Item 590 on postcard, page 225

Ring Coiler with Flanging Attachment

A Curvit C-155 coiler with special flanging attachment has been introduced by the Curvit Division, Maclodyne Corporation, East Providence, R. I. This machine rolls 5/16- to 5/8-inch flanges on stainless-steel rings 30 inches in diameter at a rate of ninety per hour.

The illustration shows this machine set up for flanging stainless-steel rings 2 1/2 inches wide by 0.109 inch thick. The coiler also can be set up to simultaneously roll and flange rings in one operation. The flanging attachment operates under a pressure of 6000 psi at 80-psi air pressure. The drive die roller is reduction-gear-driven by a 5-hp electric brake motor.

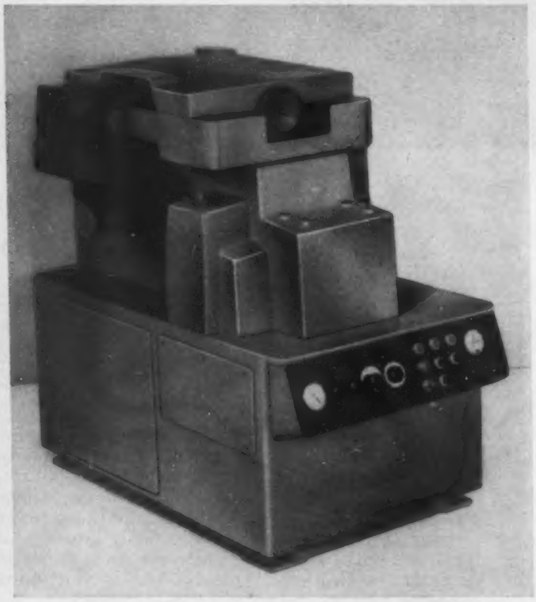
Circle Item 591 on postcard, page 225

"Winslo-Matic" Drill Pointer

A precision grinding machine for pointing drills from 0.032 inch through 1.50 inches in diameter is announced by the Winslow Product Engineering Corporation, Arcadia, Calif. Known as the Model 100 Winslo-Matic, it produces, automatically and with extreme precision, the Winslow Type 4 drill points or other helical (self-centering) points, as well as conventional ones. It produces drill points that are concentric within 0.0002 inch. Four different power-operated work-heads are available which can be quickly

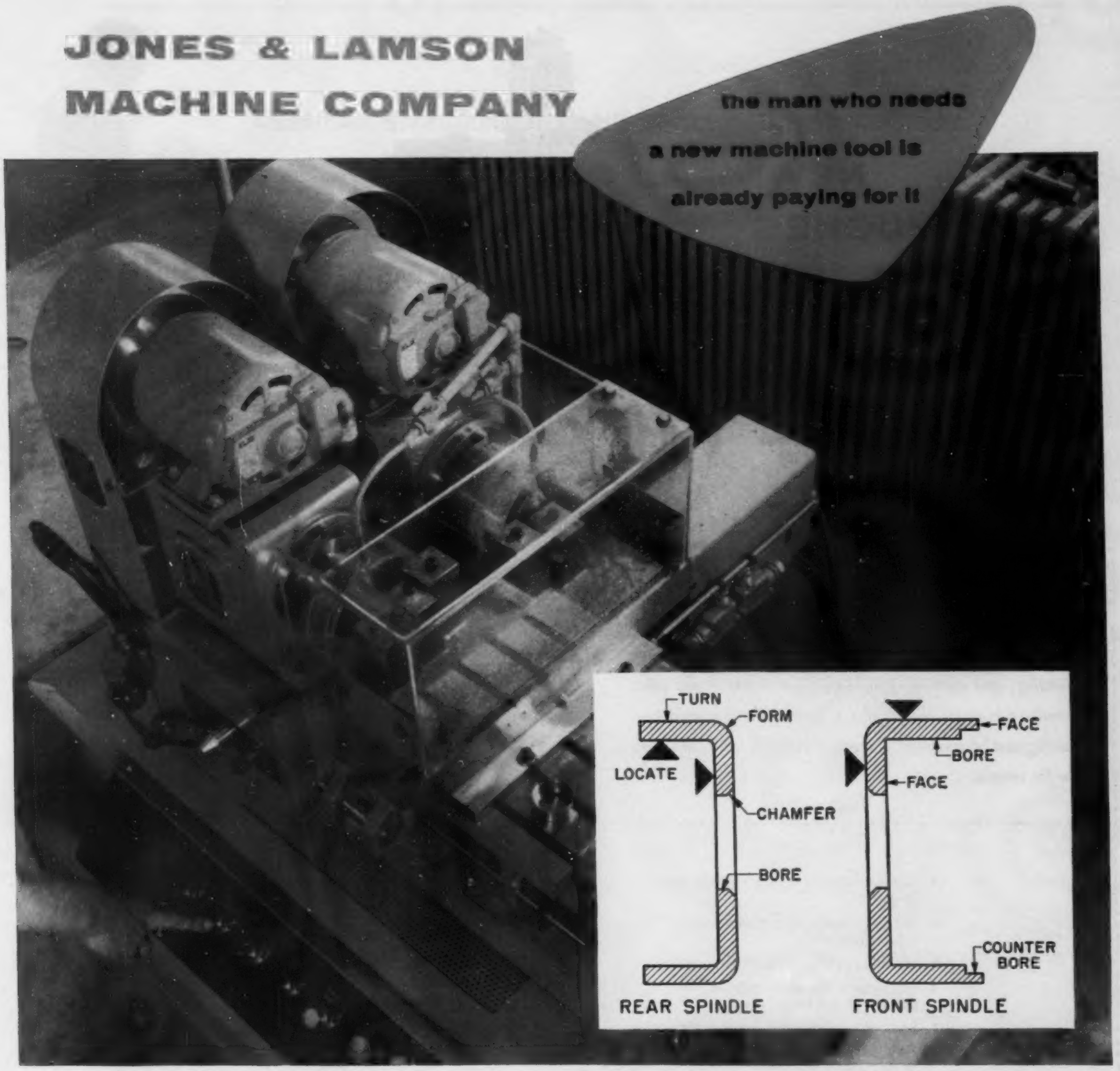
(Continued on page 209)

Curvit coiler equipped with attachment for flanging stainless-steel rings



Grinding machine for pointing drills announced by Winslow Product Engineering Corporation

JONES & LAMSON MACHINE COMPANY



Two machining operations in One 20-second cycle!

For less than $10,000 (including tooling) this J & L Twin-Spindle Precision Boring Machine does a whopping amount of work. In fact, in a single 20-sec. machining cycle, both the inside and outside surfaces of these stainless steel cups are completely machined.

The part is faced, the O.D. turned, a radius formed and the smallest hole bored and chamfered while being chucked in the rear spindle. *At the same time*, the front spindle carries another piece which has been turned around. Here the inside is faced, bored and counterbored. In effect, two operations in one machining cycle.

But that's not all. The J & L Precision Boring Machine has great versatility and accuracy. The standard spindles have a threaded nose that accepts all standard air, or manually operated, chucks. They also have an inside taper to accommodate 5C collets. Tooling combinations can be either spindle or cross-slide mounted, and can be quickly shifted for long or short runs. Operation is fully automatic.

Write for our new catalog. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

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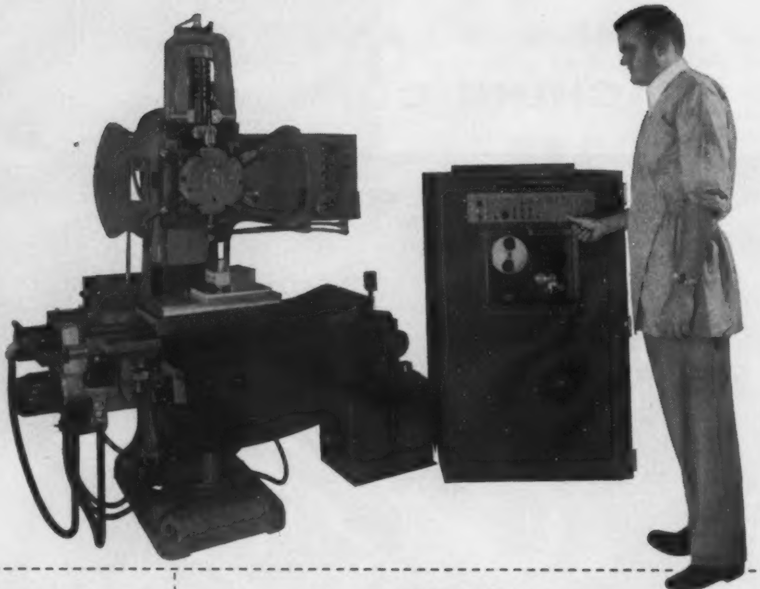
NEW! HUGHES 2-AXIS MACHINE TOOL CONTROL



The new Hughes Machine Tool Control provides you with automatic positioning of a two-axis table plus third axis feed control if desired. Designed for use in drilling, boring, turning, riveting, spot welding, punching, eyelet inserting and other similar operations, the Hughes Control offers you significant tooling and labor savings. It is easily adaptable to new machines or for retrofit.

advanced features of the new Hughes Products 2-axis machine tool control

1. Transistorized circuits.
2. Mercury-wetted relays eliminate "chatter."
3. Positioning accuracy is ± 0.0005", non-cumulative. Repeatable accuracy: ± 0.0002". Input resolution: 0.001".
4. Compact cabinet occupies minimum of valuable floor space.
5. Third axis of control easily added at nominal cost.
6. Electronic position transducer insures continuing accuracy and reliability.
7. Digital system assures positive, accurate, high-speed positioning at 180" per minute.
8. Modular construction of plug-in units cuts down-time. Spare unit simply inserted for continuous production.
9. Standard 1", 8-channel Mylar tape used in system.
10. Optical tape reader for precise, high-speed information input.
11. Tape is prepared on Hughes Products unit which is simple to operate and low in cost.

advantages

1. Simplification of tooling reduces lead time.
2. Precision positioning eliminates expensive tooling.
3. Handling is reduced between operations.
4. High-speed operation reduces the number of machines required.
5. Scrap due to operator errors is reduced.
6. Very large savings are realized in re-run of any given parts order.
7. Eliminates large inventories.
8. Rework of tooling after design changes is replaced by simple modification of machine tape.
9. The new operator produces as much as the experienced operator.
10. Cost estimating is more precise.
11. The inspection burden is greatly eased. All parts are identical.
12. Planning and scheduling is greatly simplified. Many more operations can economically be performed with one machine and one setup.
13. Tape control means the machine delivers high precision work at the same cost as low precision work. Tight tolerances at no extra cost.

other specifications

Travel	Unlimited, except that the maximum movement per block of tape is 39.999 inches.
Axis Control	Two axes simultaneously.
Drive System	"Creep Traverse Drive Unit" to be attached to preloaded ball bearing leadscrew.
Tape	1 inch, eight channel, opaque, perforated tape.
Tape Reading Time	Less than one second during feed axis movements. Does not add to machining cycle.
Drive System Power	1/4 hp (higher power in special unit).
Resolution	0.001 inch.
Auxiliary Functions	24 bits of information available—programmable as six binary coded decimal digits.
Operation Modes	1) Automatic. 2) Set-up (semi-automatic for tape and program checking). 3) Manual.
Power Requirements	110 volt, single phase. Control plus drive motors require less than 10 amps.

For further information on the Hughes Machine Tool Control...and its application to your specific needs...please write or wire: HUGHES PRODUCTS, Industrial Systems Division, International Airport Station, Los Angeles 45, California.

For export information, write: Hughes International, Culver City, California.

Creating a new world with ELECTRONICS

HUGHES PRODUCTS

SEMICONDUCTOR DEVICES • STORAGE TUBES AND DEVICES • MICROWAVE TUBES • VACUUM TUBES AND COMPONENTS • CRYSTAL FILTERS • MEMO-SCOPE® OSCILLOSCOPES • INDUSTRIAL CONTROL SYSTEMS

AMERICAN STANDARD CUT AND GROUND-THREAD TAPS—1

Designations for Ground-Thread Taps

Tap standards now provide a wider selection of Ground-Thread Taps to secure Classes of Thread Tolerance desired with maximum wear life. They also allow the user to select a tap to limits which in general will suit his individual work and equipment conditions.

While the changes are major in character because they affect nomenclature as well as pitch-diameter limits in certain ranges, they permit an easy and economical transition from previous Standards without obsolescence of existing inventory.

Prior publications designated all standard Ground-Thread Taps as Commercial Ground, Commercial Ground High, or Precision Ground. Precision Ground-Thread Taps were made to pitch-diameter tolerances of .0005", whereas Commercial Ground-Thread Taps were made to pitch-diameter tolerances varying from .001" to .0018" depending upon the diameter-pitch combination.

The Standards presented herein, introduced to industry in 1955, establish a pitch-diameter tolerance for standard taps in the size range No. 0 to 1" diameter, inclusive, at .0005", which is the same tolerance as that previously used for taps designated as Precision Ground. The pitch-diameter tolerance for standard taps in the size range above 1" to 1 1/2" diameter, inclusive, is .001" which is less than previously used for taps designated as Commercial Ground.

The Pitch-Diameter Limit Designations for Standard Tolerance Ranges shown in the succeeding data sheet permit selection of the proper tap for Class of Thread Tolerance desired and maximum wear life.

The Standards establish only one classification of Ground-Thread Tap designated as "Ground Thread." The classifications previously identified as Commercial Ground, Commercial Ground High, and Precision Ground no longer apply.

Ground-Thread Taps made to tolerances above basic are designated "High" taps, and those made to tolerances below basic, "Low" taps, and are identified by the letters "H" and "L", respectively. The tolerance ranges are indicated by a numeral after the "H" and "L" identification. This numeral discloses the number of half-thousandths (.0005) larger than basic of the maximum "H" tap or smaller than basic of the minimum "L" tap. The tolerance equals .0005 on taps 1" diameter and smaller; and .001 on taps over 1" diameter to 1 1/2" diameter, inclusive.

Example—A 1/4"—20 NC Ground-Thread Tap marked G H3 is identified as follows:

G is the symbol for Ground Thread;
H is the symbol for above basic;
3 is the symbol for pitch-diameter limits, which in this case are .001" to .0015" above basic.

Example—A 1/4"—20 NC Ground-Thread Tap marked G L1 is identified as follows:

G is the symbol for Ground Thread;
L is the symbol for below basic;
1 is the symbol for pitch-diameter limits, which in this case are .0000" to .0005" under basic.

Example—A 1 1/4"—7 NC Ground-Thread Tap marked G H4 is identified as follows:

G is the symbol for Ground Thread;
H is the symbol for above basic;
4 is the symbol for pitch-diameter limits, which in this case are .001" to .002" above basic.

It will be noted that the tolerance-range numeral divided by 2 establishes in thousandths of an inch the amount that the maximum tap pitch diameter is above basic in the H series and the amount that the minimum tap pitch diameter is under basic in the L series.

The Pitch-Diameter Limit Numbers and Limits are given on the following page—H indicating above basic (High) and L indicating below basic (Low):

Extracted from American Standard Taps—Cut and Ground Threads (ASA B5.4-1959), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

MACHINERY'S DATA SHEET

AMERICAN STANDARD CUT AND GROUND-THREAD TAPS—2

Pitch Diameter Limit Numbers for Taps to 1" Diameter, Inclusive

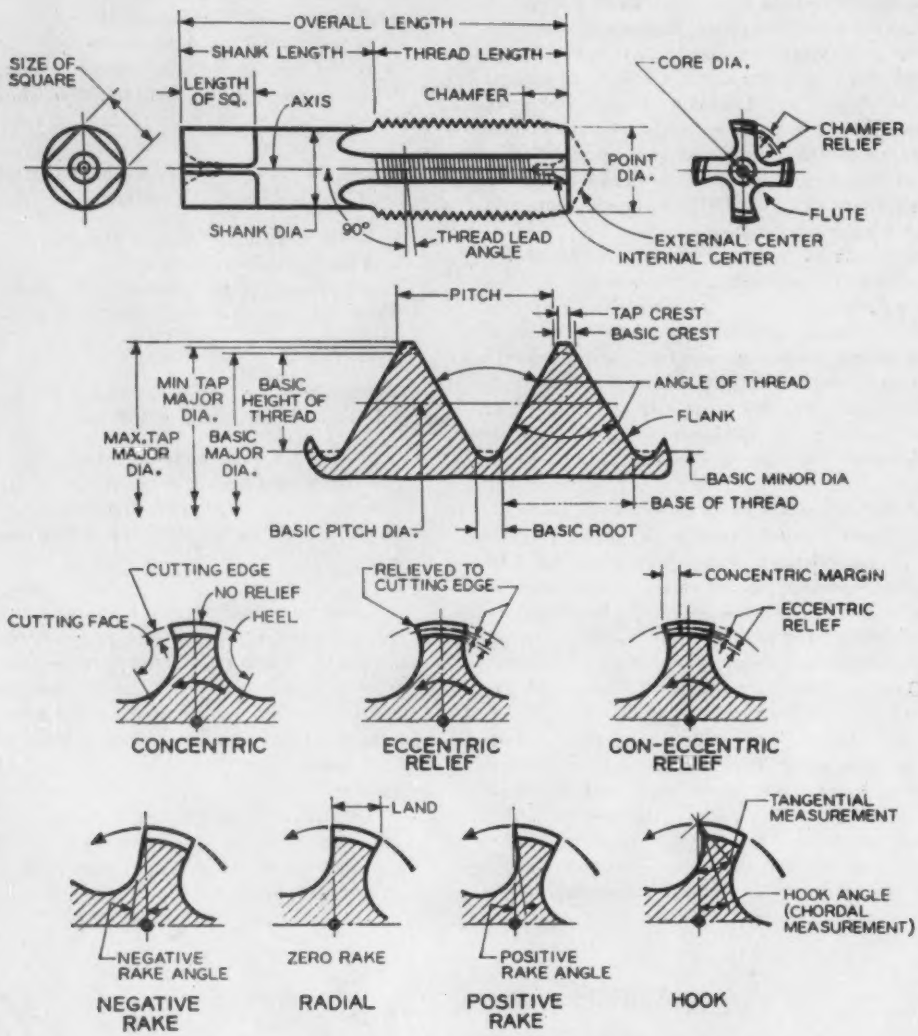
L1 = Basic to basic minus .0005"
H1 = Basic to basic plus .0005"
H2 = Basic plus .0005" to basic plus .001"
H3 = Basic plus .001" to basic plus .0015"
H4 = Basic plus .0015" to basic plus .002"
H5 = Basic plus .002" to basic plus .0025"
H6 = Basic plus .0025" to basic plus .003"

Pitch Diameter Limit Numbers for Taps Over 1" Diameter to 1 1/2" Diameter, Inclusive

H4 = Basic plus .001" to basic plus .002"

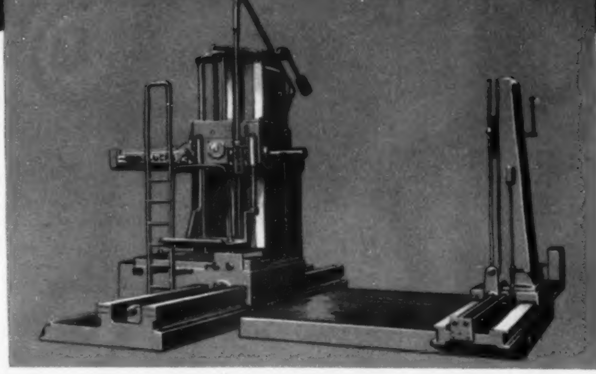
The tables shown in data sheets to be published in January, 1960, Machinery present a guide for assisting in the selection of the proper tap to produce a desired Class of Thread Tolerance under normal conditions. By reason of the ranges of tap limits it is possible to meet more nearly the requirements of users and to provide maximum wear life.

SKETCH ILLUSTRATING TAP TERMS



Extracted from American Standard Taps—Cut and Ground Threads (ASA B5.4-1959), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.


boring
drilling
milling



changed to accommodate any drill in the capacity range of the machine. Operation is on a continuous cycle. Forms are generated by means of a combination of two cam movements. The drill point is formed on a 20-inch-diameter grinding wheel. After being ground, the drills are automatically ejected.

In addition to sharpening the point on all standard drills, the point on most drill countersinks can also be sharpened with this machine. The production rate is variable for sizes and types of drill material. Small drills can be pointed in three seconds. A pacesetter adjuster sets the interval between cycles. An outstanding feature of this drill pointer is the fully automatic, self-compensating wheel dresser. Indexing is controlled at the point of the drill so that no adjustment is required for variations in drill length. A pressure coolant system is provided and the wheel and head are well-guarded to retain the coolant and spray.

The grinder spindle is powered by a 1-hp motor and the hydraulic system is powered by a 1 1/2-hp motor. The unit occupies a floor space approximately 36 by 48 inches and has a height of about 54 inches.

Circle Item 592 on postcard, page 225

Fig. 1. Carlton horizontal boring and drilling machine with numerical control

Numerical Control for Carlton Machine Tools

The Carlton Machine Tool Co., Cincinnati, Ohio, in conjunction with the Carlton Controls Corporation, has combined horizontal and planer type boring and drilling machines with a recently developed numerical control. This new combination, shown in the accompanying illustrations, Figs. 1 and 2, has been developed to speed up drilling operations and improve the quality of work. It is also expected that this equipment will eliminate the expense of jigs and tooling, as well as make fuller use of drilling machine tools.

Three separate methods of programming control are provided by this equipment: (1) It provides tape control for automatic three-axis positioning of the tool, plus automatic speed-feed changes. Standard 1-inch-wide eight-channel tape is used. Zero offset establishes a new starting point from the work-piece regardless of location; (2) a keyboard for separate, nontaped operations provides manual input of five- or six-digit numerical data for each axis. Numerical values, actuated by keyboard or tape, are presented visually by indicator lights; and (3) Push-buttons control both rapid- and slow-traverse power-driven units and position the axis movements for manually operating the machine to establish different data points.

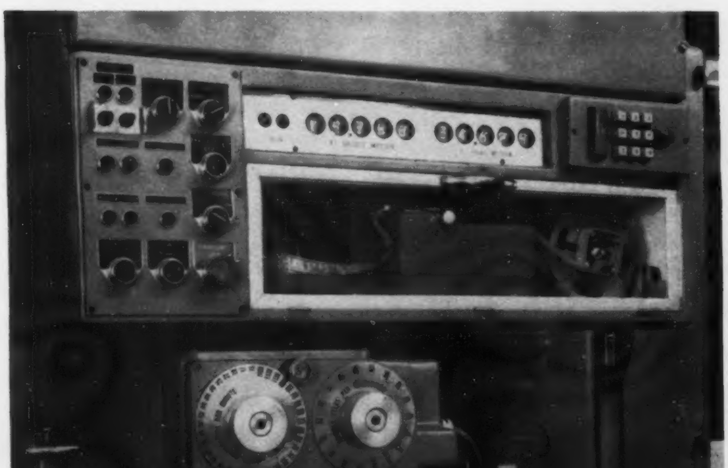


Fig. 2. Close-up of numerical control announced by the Carlton Controls Corporation

Circle Item 593 on postcard, page 225

(This section continued on page 210)

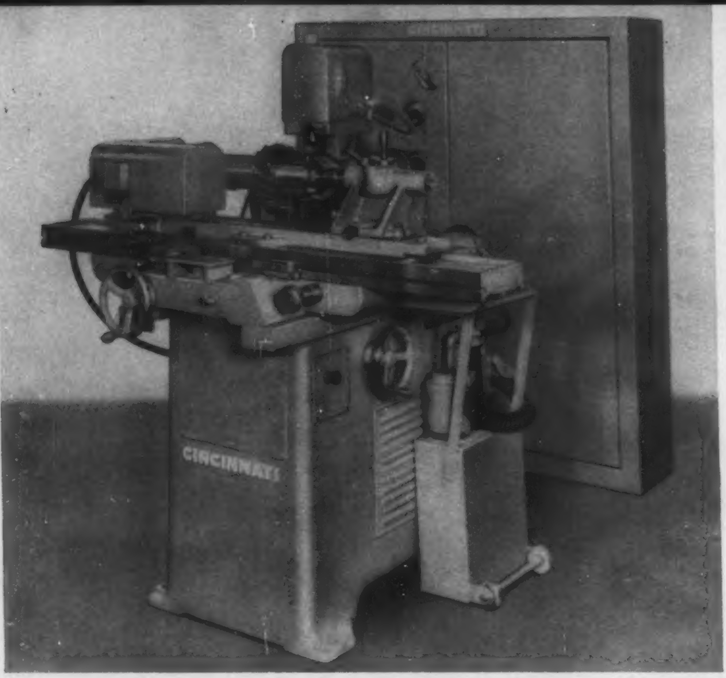


Fig. 1. Cincinnati automatic cutter grinder with wheel-truing attachment

Automatic Cutter Grinder

The simplicity and automatic features of a cutter grinder announced by the Cincinnati Milling Machine Co., Cincinnati, Ohio, are said to enable the operator of a milling machine to sharpen his own cutters while maintaining production. Once the cutter grinder is set up, it will sharpen identical cutters without attention from the operator. The uniformity or interchangeability of cutters ground on this machine, Fig. 1, serves to increase the number of work-pieces milled between cutter sharpenings. Either right- or left-hand plain- or stagger-tooth cutters can be ground.

One of the outstanding cost- and time-saving features is the automatic truing of the grinding wheel. The operator need only decide how many teeth he wishes to grind between truings and how many passes of the truing diamond will be required. Settings are then made for these numbers on the control panel. At the pre-set intervals, the diamond advances 0.001 inch per pass and makes as many passes as have been programmed. Compensation for each 0.001-inch advance of the truing attachment is provided by a saddle pick-feed.

The saddle, operating on ball tracks, can be dial-set to pick-feed between 0.00025 and 0.005 inch in increments of 0.00025 inch. Both rough and finish pick-feeding can be set individually anywhere within this range. A variable-torque motor indexes the cutter into proper position against the tooth-rest. A second torque setting, preselected on the control panel, establishes the proper pressure between cutter tooth and tooth-rest for smooth feeding along the helix path during the grinding operation. A limit switch indexes the cutter at the end of each tooth-grinding stroke.

Eight counters on the machine panel permit quick selection of the desired cycle. These counters control the number of rough-grinding revolutions of cutter; number of finish revolutions; number of cutter teeth; 180-degree rotation for concentricity; number of teeth for roughing pick-feed; finish pick-feed; number of teeth ground between wheel truings; and number of truing passes.

Selector switches on the panel

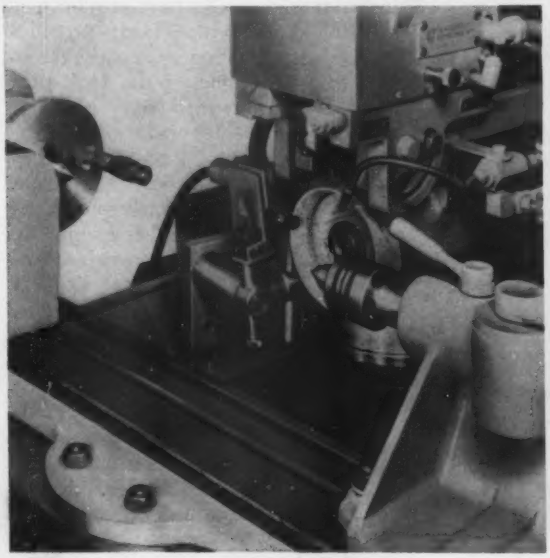


Fig. 2. Wheel-truing attachment of machine in Fig. 1

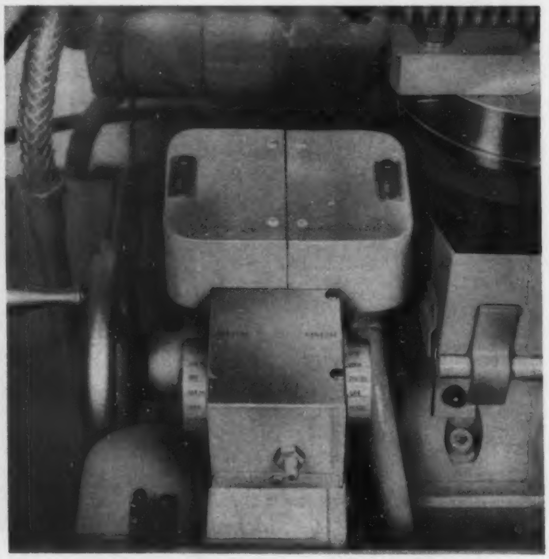


Fig. 3. Saddle pick-feed on Cincinnati cutter grinder

control the direction of grinding-wheel rotation; coolant flow; selection of manual or automatic operation; setting for helical or stagger tooth; and adjustment for either straight or cup wheels. Lights on the control panel immediately indicate the portion of the cycle that is active at any time. The automatic cycle can be interrupted and then resumed.

Circle Item 594 on postcard, page 225

Numerical-Control System for Rotary Profile-Milling Machines

The Industrial Controls Section, Bendix Aviation Corporation, Detroit, Mich., has developed a two-axis numerical-control system to facilitate the economical machining of parts having complex forms on rotary type profile-milling machines. In one typical application, this system provides continuous-path control of rotary-table motion and linear tool motion on a Kearney & Trecker rotary profile-milling machine. This equipment machines the complex outside contour of stainless-steel jet-engine housings. The spindle of this machine has a 10-hp drive and its speed is infinitely variable from 40 to 600 rpm at constant horsepower through the use of a variable-displacement hydraulic motor and pick-off gears. The rotary table has feed rates up to 375 degrees per minute and the column (linear axis), a maximum feed of 15 inches per minute.

This numerical-control system provides a versatile method of machining any number of different part shapes with only one machine tool. Other typical parts machined with rotary profile mills controlled by the Bendix two-axis system are those with two-dimensional contours, of the type usually defined by polar coordinates, such as two-dimensional cams and rotary compressor-blade housings for jet engines. The numerical-control system illustrated provides command pulses of 0.0002 inch to the linear axis and 0.002-degree command pulses to the rotary axis. It will simultaneously control both rotary-table motion and cutting-tool linear motion on rotary profile-milling machines.

The circuits of the two-axis machine-control unit are almost exclusively digital in nature. These circuit units are mounted in plug-in packages and printed-circuit wiring is used within the packages.

Circle Item 595 on postcard, page 225

Motor-Load Indicator for Vertical Surface Grinders

The Blanchard Machine Co., Cambridge, Mass., announces the introduction of a motor-load indicator which is now available as optional equipment on their No. 11 and No. 18 vertical surface grinders. This indicator is designed to replace the ammeter in the wheel-motor circuit to indicate very slight changes in pressure between grinding wheel and work.

An ammeter, measuring the current to a lightly loaded induction motor, is relatively insensitive to small changes of power. The motor-load indicator, however, with its built-in corrective network, is sensitive to the power, rather than the current alone. Applied to machines which are used for extremely accurate work, or on which the load is very light, the motor-load indicator greatly facilitates operation.

The design specifications for this meter were drawn up by the Blanchard Machine Co. to satisfy a definite need. The circuit was designed and the unit is now being built by the Westinghouse Electric Corporation.

Circle Item 596 on postcard, page 225

(This section continued on page 214)

Bendix two-axis machine control unit for rotary profile-milling machines

Motor-load indicator applied to Blanchard vertical surface grinding machine


LINDNER

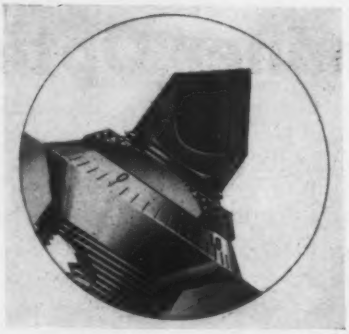
Electric Erosion Machine

Electro-Spark Co., Inc., New York City, has announced a Model E-500 electric erosion machine designed for the rapid and accurate machining of tungsten carbides, hardened steels, and other metals by the electric erosion process. This machine has certain advantages over the Model E-400.

All the electric equipment is now located in the head of the machine, where it is more readily accessible to the operator or maintenance man. It can be swung open for inspection or repairs, and can be thoroughly checked whenever desired without any waste of time. A new auxiliary motor has been added to raise the entire head of the machine during setups.

The electric system has also been improved to make it possible to obtain a superior finish—as high as No. 10 microfinish. A horizontal automatic feed, besides the vertical one, is now standard equipment in this machine. A threading attachment for cutting threads up to the 1 1/2-inch size is optional.

Circle Item 597 on postcard, page 225



Microbore tool with titanium-carbide and ceramic tips

Titanium-Carbide and Ceramic-Tipped Tools

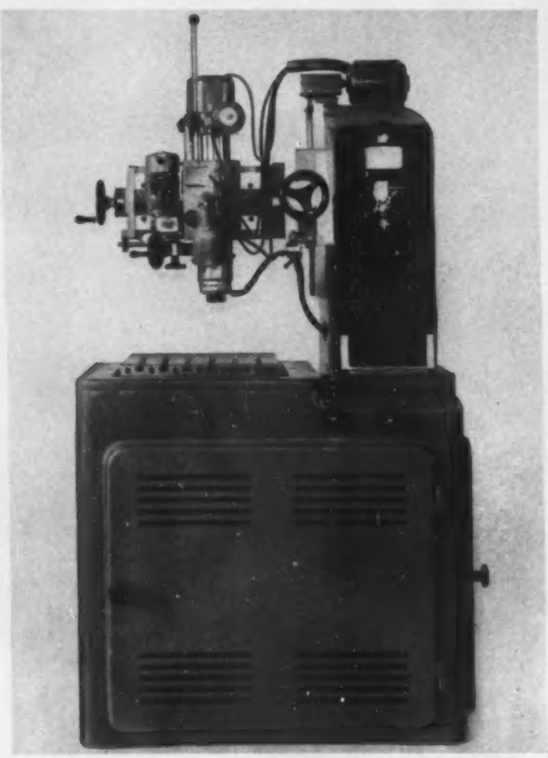
The DeVlieg Microbore Division of DeVlieg Machine Co., Royal Oak, Mich., has brought out Microbore tools with titanium-carbide and ceramic tips which are said to permit feeds and speeds impossible to attain with any other type of cutting material. These tips produce a surface that in some instances is comparable to a ground finish.

Both the titanium-carbide and ceramic-tipped Microbore tools are cone-relief-ground to gage-room accuracy. Cone-relief grinding provides uniform clearance around the profile of the cutting edges that serves to increase tool life. A double-cone bearing axial locking force and minimum of overhang between cutting tip and cone-seat assembly provide the rigidity necessary for optimum results with these new cutting materials.

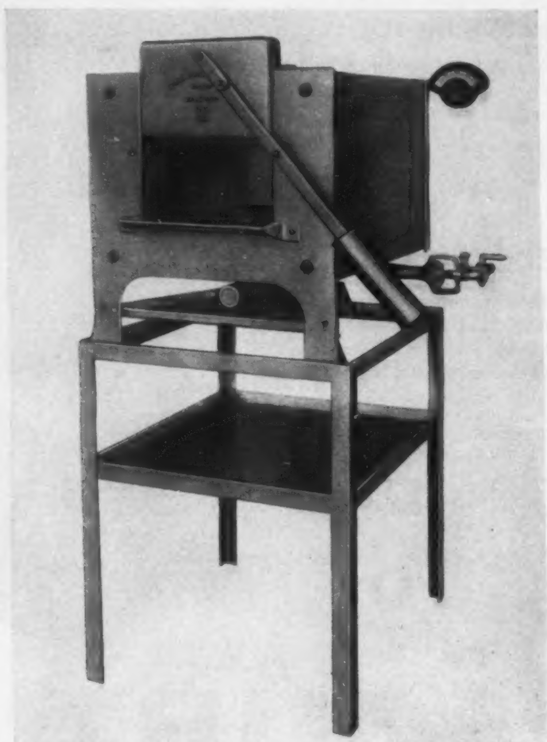
Circle Item 598 on postcard, page 225

Improved "Buzzer" Heat-Treating Furnace

Charles A. Hones, Inc., Baldwin, N. Y., has announced a number of important engineering changes in the standard "Buzzer" Model No. 55 bench type oven furnace it has manufactured since 1911. A new cast-iron venturi burner with modernized port design replaces the previous machined-steel burner. This new burner takes reflected heat more efficiently. A new hearth mix in a special Hones silicon-carbide formula exceeds previous shock limits and provides greater resistance up to 2000 degrees F.



Erosion machine announced by the Electro-Spark Co., Inc.



Heat-treating furnace announced by Charles A. Hones, Inc.

THE TONY ACCETTA "PET" SPOON, made of Revere Brass Strip has been awarded the Medal of Honor by Sportsman's Club of America for superiority of design and fish-getting ability while all Tony Accetta Baits have received National Sportsman's Research Award . . . a real tribute to design, construction and effectiveness.

Revere helps "fit the metal to the job"

AND A BAIT MAKER SAVES ON FORMING AND FINISHING COSTS WHILE PRODUCING AWARD-WINNING LURES

The fishing lures of Tony Accetta & Son, Riviera Beach, Florida, are known all over the world for their ability to catch fish. That's due to design. They are also known for their fine workmanship and ability to take a hammering on rocky reefs and shoals, and still retain their ability to attract fish. That's due to the material from which they are made . . . a Revere Brass with special grain size and finish.

Says the Senior Accetta, "The high quality of Revere Brass has, without a doubt, contributed immeasurably to the quality of our lures. In fact, Revere Brass is of such fine quality and finish, uniform grain size and structure that even after stamping and forming only a minimum of work is required prior to chromium plating. This means we save on both forming and finishing costs. Since we have been using Revere Brass we have not had a single customer complain due to poor quality material."

Why not put the extensive knowledge of Revere's sales representatives to work for you? With the wide variety of metals at their disposal, perhaps they can help you select the metal best suited for the job, with a resultant saving of money while improving product quality.

REVERE COPPER AND BRASS INCORPORATED
230 Park Avenue
New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Fort Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

The furnace is now equipped with an integral easily lit, reliable pilot for faster, simplified operation, and a new higher-powered venturi which entrains more primary air, and provides higher flame temperatures, quicker combustion, and cleaner results. The new unit is said to be unusually quiet in operation. It will handle a wide range of heat-treating work on low-carbon steel and preheating operations on high-speed steels and numerous other metalworking functions without the need for an air blower. The improved furnace is available in six standard size models with stand. Completely packaged automatic temperature controls can be furnished if desired.

Circle Item 599 on postcard, page 225

"Adjust-O-Breaker" Tool-Holder

A tool-holder for disposable carbide inserts featuring an indexing, fully adjustable chip-breaker of solid carbide has been introduced by the Metallurgical Products Department of the General Electric Co., Detroit, Mich. Called the Carboloy "Adjust-O-Breaker," this device is designed to provide positive setting of the chip-breaker, and infinite adjustment within its range through use of a locating pin mounted on a lead-screw in the holder shank. The lead-screw axis is parallel with the path followed by the cutter.

The solid-carbide, double-edged chip-breaker is full-floating, providing for uniform pressure distribution over its surface, thus preventing strain cracks and breakage of the insert from line or point pressures. No pressure is taken on the chip-breaker holding screw, the locating pin, or the adjusting screw, as the cutting force is taken by the rail and major clamp screw. The chip-breaker is completely removable, and both it and the clamp are held in proper alignment by keys and key slots.

Five styles, in both left- and right-hand models, are available in three different sizes, making a total of thirty negative-rake tool-holders in the line. Carboloy Adjust-O-Breaker holders have been thoroughly tested in the field with highly satisfactory results. In one test conducted on extremely hard material, a 4340 steel forging of 300 Brinell hardness was machined at 250 sfpm (surface feet per minute) with 0.017-inch feed, in a 1/4-inch cut, with the Adjust-O-Breaker chip-breaker producing nicely curled chips. The clamp provides a means for making continuous positive adjustments until short chips of the proper length are produced.

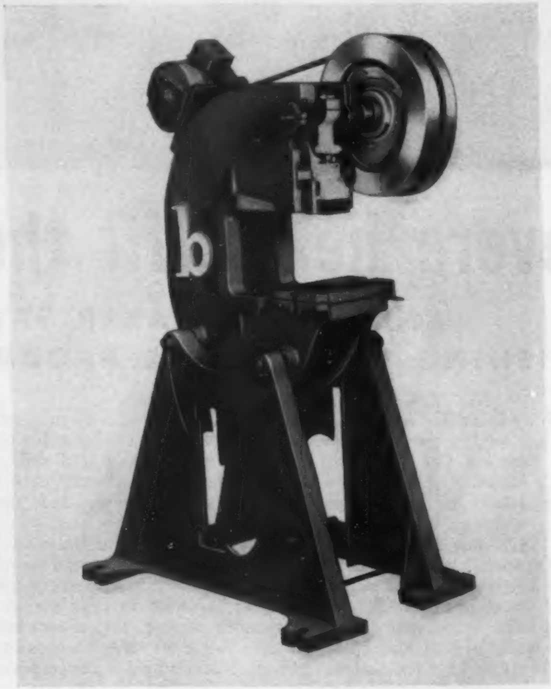
Circle Item 600 on postcard, page 225

Benchmaster Power Punch Press

A Series "90" 8-ton power punch press for jobs requiring unusual vertical or horizontal die space has been announced by the Benchmaster Mfg. Co., Gardena, Calif. A choice of three shut heights—7 3/4, 10 3/4, or 13 3/4 inches—with standard 1 1/4-inch stroke (stroke down) is available. These measurements are without bolster plates. Other strokes of 1 1/2, 2, 2 1/2, and 3 inches can be supplied on order, as well as strokes of 1 inch and less. The press operates at 180 to 190 strokes per minute on a direct drive when using

(Continued on page 218)

Assembled and partly disassembled views of Carboloy "Adjust-O-Breaker" tool-holder



Power punch press placed on the market by the Benchmaster Mfg. Co.

For more data, circle this page number on inquiry card

a 1/2-hp motor with a speed of 1725 rpm. The bed area is 8 by 11 inches with 12-inch clearance between center of slide and frame.

This Series "90" 8-ton, open-back inclinable press is available in both direct belt-drive and back-geared models. Geared models develop 40 to 100 strokes per minute.

Circle Item 601 on postcard, page 225

Magnetrace Automatic Profiler

An all-new machine tool designed and built from the base up specifically for 360-degree profile milling under tracer control is announced by the Pratt & Whitney Co., Inc., West Hartford, Conn., who will sell this profiler for its manufacturer, the New England Machine & Tool Co., Berlin, Conn. This automatic profiler, known as the "Magnetrace," operates by following an easily prepared sheet-steel template with a stylus. The machine is said to reproduce complex, irregular two-dimensional shapes with the speeds, feeds, and accuracy usually associated with precision, plain milling operations.

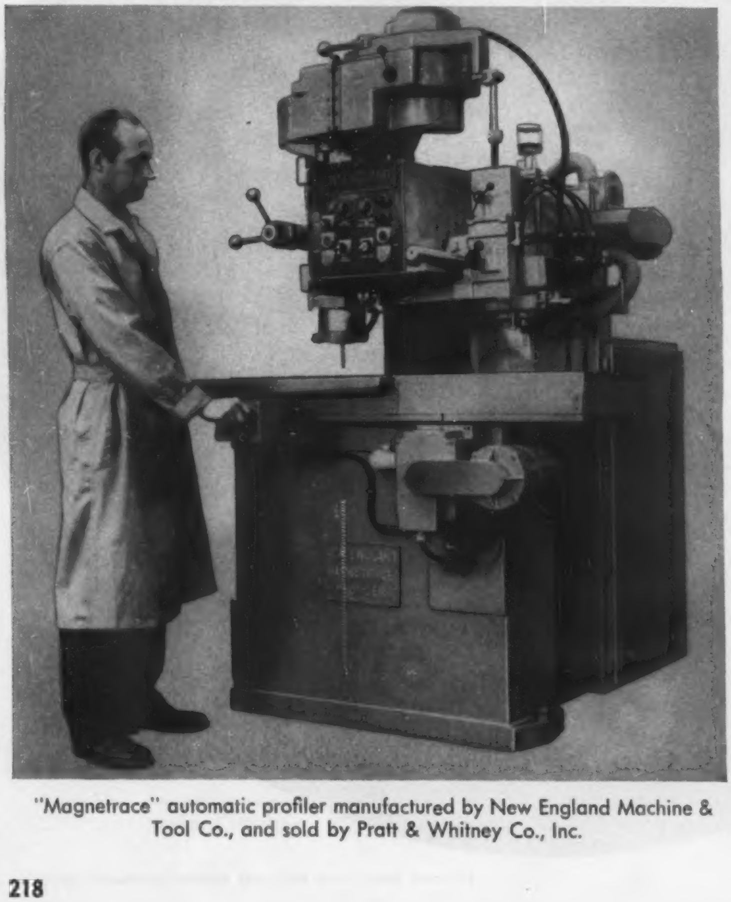
The exceptionally high accuracy claimed for this profiler is said to result from the over-all precision and rigidity of the machine itself, the complete elimination of backlash in the slide motions, and the extreme sensitivity of the tracer system. The tracer requires a stylus deflection of only 0.0002 inch to activate the table and cross-head drives.

The Magnetrace is equipped with a 5-hp spindle drive, and provides seven speed changes with a total range of 375 to 5200 rpm. This powerful drive—plus the fact that the tracer always follows the template at a constant pre-set feed (up to 80 inches per minute)—is said to produce unusually fast metal removal with fine finishes and greatly increased cutter life. As a result, it is claimed that many jobs previously requiring roughing and finishing cuts can be completed on the Magnetrace in a single pass, with consequent savings in machining time and costs.

The only tooling required consists of a suitable work-holding fixture, a simple, mild-steel template, and a tracer stylus the same diameter as the cutter. This simple tooling, plus the provision of micrometer adjustments for quick, accurate alignment of cutter and tracer, is said to make machine setup very fast and simple.

Moderate to high production work can be handled economically by the addition of simple tooling designed to permit operation under fully automatic cycle control. With this tooling, the operator has only to drop the work-piece into a fixture, press the cycle-start button, and pass on to the next machine.

Circle Item 602 on postcard, page 225



"Magnetrace" automatic profiler manufactured by New England Machine & Tool Co., and sold by Pratt & Whitney Co., Inc.

Rivett Internal Grinder with High-Speed Spindle

Spindle speeds up to 100,000 rpm are now available on the standard Model 84 internal grinder built by Rivett Lathe & Grinder, Inc., Boston, Mass. The high-frequency spindle drive on this grinder was developed in co-operation with the Allentown Works of Western Electric for the purpose of grinding small holes with tolerances of plus or minus 0.0004 inch.

The 100,000-rpm spindles are powered by a high-frequency electrical wheel-head securely mounted on the bed with an extra-heavy bracket to assure extreme accuracy. Hole sizes from less than 1/8 inch up to 3 inches in diameter may be ground to a micro-inch finish. The spindle has oil-mist lubrication and is water-cooled.

The Rivett Model 84 internal grinder is equipped with an automatic infeed to provide 0.0006- to 0.00001-inch infeed. This fine infeed is especially adapted for grinding thin-wall pieces of extra-light metals. The high-frequency alternator, the oil-mist lubrication system, the coolant tank, and the control panel are mounted in a separate cabinet adjacent to the machine.

Circle Item 603 on postcard, page 225

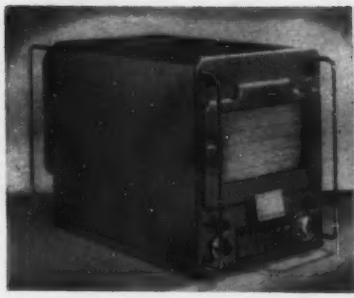


Fig. 1. (Left) UI Reflectoscope for contact and immersed inspection. Fig. 2. (Center) UM Reflectoscope features interchangeable plug-in units. Fig. 3. (Right) Ultrasonic thickness gage with direct-reading meter

Sperry Ultrasonic Flaw Detectors and Thickness Gage

Transistorized ultrasonic equipment added to the line of Sperry Products, Inc., Danbury, Conn., includes two Reflectoscope flaw detectors and a thickness gage. Type UI Reflectoscope (Fig. 1) is suitable for both contact and immersed inspection, and can be mounted directly on existing scanning bridges. It has a 12-inch dual-trace tube, visible from a considerable distance, with a two-color display which readily distinguishes flaw indications from range marks.

The instrument weighs 100 pounds, and has a frequency range from 1.0 to 25.0 megacycles. Maintenance is facilitated because of the use of printed circuits, transistors, and plug-in units.

The UM Reflectoscope (Fig. 2) is a portable instrument, weighing only 35 pounds. Low-cost, interchangeable, plug-in units permit the selection of only the necessary components for each testing job. The basic equipment consists of a 5-inch cathode-ray tube, display controls, and instrument power supply as well as a pulser-receiver and a time control. It is possible to add alarm and recording attachments, attenuation-correction circuits, and counting and totalizing channels.

The thickness gage (Fig. 3) weighs approximately 10 pounds and is no larger than a portable radio. Because it uses transistors and low-voltage batteries, it is explosion-resistant. Measurements are read directly on a meter. Alarm lamps are provided to set thickness limits. These prove useful when the instrument is set up as a go-no-go gage or is used in poorly illuminated areas. Employing a pulse-echo principle, the gage can measure thickness even where surfaces are not parallel, or are pitted or rough. Maximum thickness that can be gaged is 3 feet in aluminum or steel; minimum thickness is 0.060 inch in aluminum, and 0.070 inch in steel.

Circle Item 604 on postcard, page 225

Reset Indicators Designed for Lubrication Systems

The Trabon Engineering Corporation, Solon, Ohio, has developed a new "trouble" indicator for progressive type centralized oil and grease systems. Previously introduced indicators were of the rupture-disc type and required removal of the indicator cap and replacement of the rupture disc.

The reset indicator, Fig. 1, available in a wide range of spring pressures (from 250 to 2500 psi) pinpoints a blocked-line condition in the centralized lubrication system. When a blocked condition is cleared, the indicator pin will

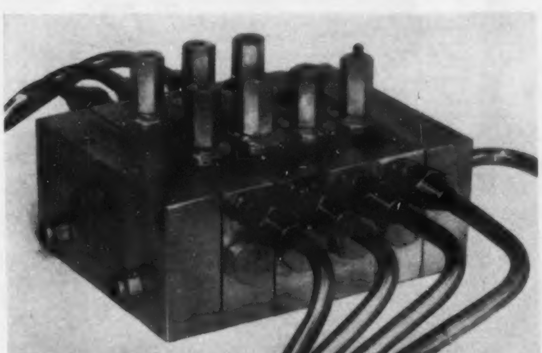


Fig. 1. Reset indicator for lubrication system developed by the Trabon Engineering Corporation

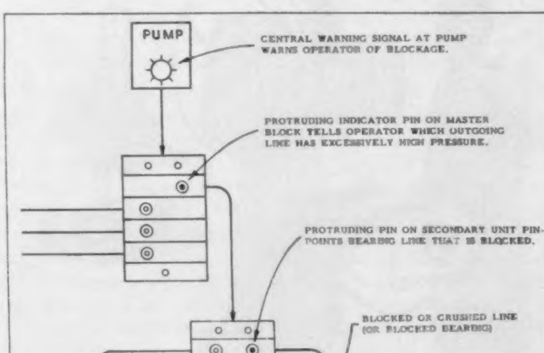


Fig. 2. Typical layout of series Type M oil or grease system equipped with Trabon reset indicators

automatically return to "normal" position.

Available in 1/8-inch NPT and 1/4-inch NPT sizes, the reset indicator is screwed into the alternate outlet or test-plug tap of each outgoing line from the master and secondary distributors of the progressive Type M or MX lubricating system. A typical layout of a series Type M oil or grease system equipped with reset indicators is shown in Fig. 2.

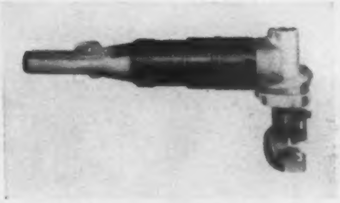
Circle Item 605 on postcard, page 225

Six-Spindle Turret Drilling Machines

The Burgmaster Corporation, Gardena, Calif., has brought out a Model 1C six-spindle turret drilling machine as a companion to its bench Model "O" machine. The Model "O" is rated to drill up to 1/4-inch-diameter holes in steel and the Model 1C, 1/2-inch-diameter holes in cast iron. Both machines have power-indexing turrets which index at the operator's command.

Spindle speeds and depth control are pre-selective and are automatically shifted as the spindle indexes. These machines are especially adapted for precision sensitive drilling of small parts such as are found in the electronic, aircraft, and missiles fields.

Circle Item 606 on postcard, page 225



Buckeye heavy-duty nibbler

Heavy-Duty Nibbler

The Buckeye Tools Corporation, Dayton, Ohio, has brought out a heavy-duty nibbler which will cut through No. 8 gage mild steel or No. 10 gage stainless steel at the rate of 6 feet per minute and leave both edges of the cut free from distortion. Designed for straight or contour cutting of sheets too large for stationary cutting tools, this lightweight nibbler can be easily carried to the job. Cuts may be started at the edge of the sheet or at any point on the surface where a small access hole is provided. The minimum cutting radius is 5 inches. The high-speed, vertical punching motion takes sharp, rectangular bites 1/4 inch wide out of the metal. The inexpensive punch and die arrangement can be resharpened many times.

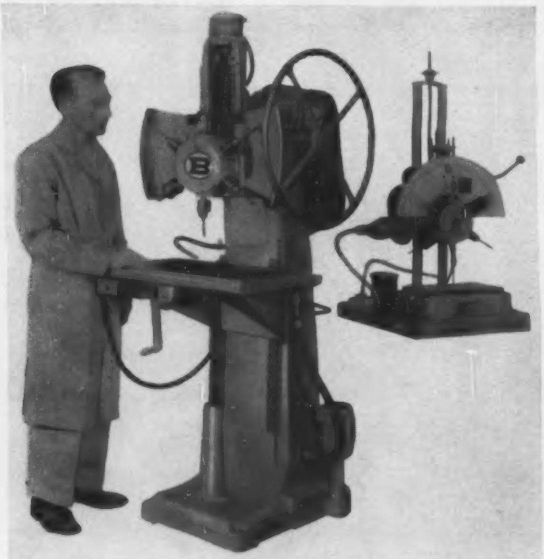
Compressed air at 90 to 100 psi entering the tool through a 3/8-inch hose provides maximum operating efficiency. Air flow to the motor is controlled by either a safety lever or a thumb-flip throttle. The tool is 15 inches long and weighs 12 1/2 pounds. A universal electric version of the same tool is built for operation on a 115-volt, 60-cycle circuit.

Circle Item 607 on postcard, page 225

Thin-Wall-Tube Cutter

A tube cutter designed to cut thin-wall tubing of various metals in any length with a minimum or complete absence of burr has been brought out by the Special Machine Co., Winsted, Conn. Employing the principle of parting metal, this machine is dustless and chip-free in operation. The cutting head is engaged by an air cylinder activated by an electric limit switch and it is also equipped with a manual engaging lever.

Tubing is fed to the desired length through a guide in the operating head. The cutting head is engaged by contact with a pre-set electric limit switch which activates an air cylinder, or the air cylinder may be activated by a manual lever. When engaged, the cutters and supporting-roller idlers converge on the tubing and complete the cut. One cutter or three cutters will be employed, depending on the material and wall thickness of the tube. The No. 104

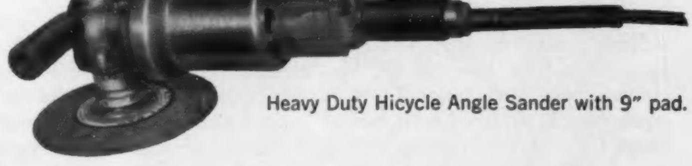


Turret drilling machines built by Burgmaster Corporation

Burrless tube cutter made by the Special Machine Co.

ANNOUNCING NEW HEAVY DUTY 6" AND 8" HICYCLE GRINDERS

Heavy Duty Hicycle Angle Grinder with rotating wheel guard.



Heavy Duty Hicycle Angle Sander with 9" pad.

Model CP-550-SG-4500 Heavy Duty Grinder maintains speed under load, lets the operator really lean into the work.

Here are two *all new* CP heavy duty Hicycle Grinders . . . brutes for power, demons for speed. Hicycle squirrel-cage induction motors running on 180 cycles, 220 volt, 3 phase current provide Built-in Overspeed Protection because maximum speed is always constant, always within safe wheel limits . . speed sag under load is less than 15%.

New with these models is the CP *"Tri-Flo" Cooling* System that minimizes "hot spots". This highly efficient system cools motor windings, rotor shaft, main bearings, gear case and switch. Keeps the temperature rise at key points as much as 28° lower than with conventional type cooling.

You get these 7 extra advantages with CP Hicycle Grinders

1—*Hicycle Motor* of advanced squirrel-cage design means no brushes to replace, no armature to burn out. 2—*Power/Weight Ratio* is outstanding because high strength magnesium castings are used for motor, gear case and switch handle. 3—*Oil Sealed Ball Bearings* lubricated for life. 4—*Interchangeable* motors, motor housings, switch handles and switches on all straight and angle models. 5—*Heavy-duty switches* have dust tight seals and phenolic spacers for insulation from motor and to minimize vibration. 6—*Extra heavy micro-mesh gearing* heat-treated for long service. 7—*Guards* fully conforming to A. S. A. safety codes.

Write for complete information on these newest CP Hicycle Heavy Duty Grinders. Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.

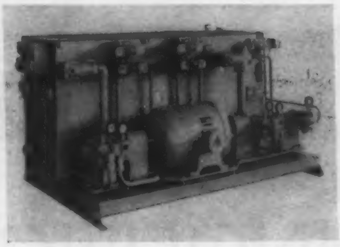
Chicago Pneumatic

ELECTRIC TOOLS • PNEUMATIC TOOLS • AIR COMPRESSORS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

standard model will cut tubing 1/4 to 3/4 inch in diameter and in lengths to 48 inches. Adaptation to any length is provided as necessary by extending the track of the electric limit switch. Other models are offered to handle diameters up to any required size.

Circle Item 608 on postcard, page 225

Multiple-Pump Hydraulic Power Unit



"CircuitMaster" hydraulic power unit

A multiple-pump hydraulic power unit of a new L-shaped design is now being manufactured by Double A Products Co. (a subsidiary of Brown & Sharpe Mfg. Co.), Manchester, Mich. This "CircuitMaster" unit reduces the amount of external piping and valve panels by 40 per cent or more. It was originally built to power a core blower in an automated foundry. With the clutter-free top removed, the fluid from individual drain and return lines can be seen while the unit is running, a feature which serves to speed up trouble-shooting.

One double-end electric motor drives five separate pumping stations which are automatically controlled by high-low valve panels and solenoid-controlled relief valves. External connections are brought out to a convenient flanged manifold (extreme left) for easy hookup.

Circle Item 609 on postcard, page 225

Rotary-Table Milling Machine for Processing Nonferrous Parts

A machine designed for face-milling nonferrous parts has been brought out by the Onsrud Machine Works, Inc., Niles, Ill. This equipment is supplied with attachments for secondary operations and provides the unusual combination of high milling speeds and fast rotary-table feeds. It is built to have the rigidity of the finest bed type machine and to assure high production and accuracy in milling aluminum or any other nonferrous metal. The basic machine has a single vertical head for face milling. A second milling head can be supplied as extra equipment. The latter head makes possible, in a single pass, such double operations as roughing and finishing, face milling, and profiling or milling at two elevations.

Identified as the Onsrud MM-48 Mach-Mil, this machine is the first of a series of types to be offered. For the majority of face-milling operations, the rotary feed table provides the following advantages: (1) the feed motion is continuous, (2) no production time is lost for loading and unloading, (3) the cutter is not dragged over the finished surface during a return stroke, (4) higher table feeds can be employed, and (5) multiple operations in a single pass, using the second milling head, are easily performed, including operations such as combination roughing and finishing or profile milling.

To achieve the degree of accuracy required in production milling, this equipment has been designed to provide maximum rigidity. The machine is equipped with a specially designed high-speed milling head of the type used successfully for many years in aircraft production. This type of head provides the high-speed cutter rotation desirable for milling nonferrous metals, particularly the aluminum alloys.

The table has a work-surface diameter of 48 inches. Vertical adjustment of the face-milling head ranges from 2 to 15 inches, measured from table surface to spindle nose. The column position is also adjustable, providing a radial adjustment of the milling head relative to the table ranging from 12 to 28 inches, measured from table center to projected axis line of the spindle. One of many milling heads available is a 10-hp motorized spindle unit with a speed of 600 rpm. High-speed table drives are available in a choice of two speed ranges. The standard rotary-table drive provides an infinitely variable peripheral feed rate of 18 1/2 to 150 ipm (inches per minute) and the optional table drive provides an infinitely variable peripheral feed rate of 37 to 300 ipm.

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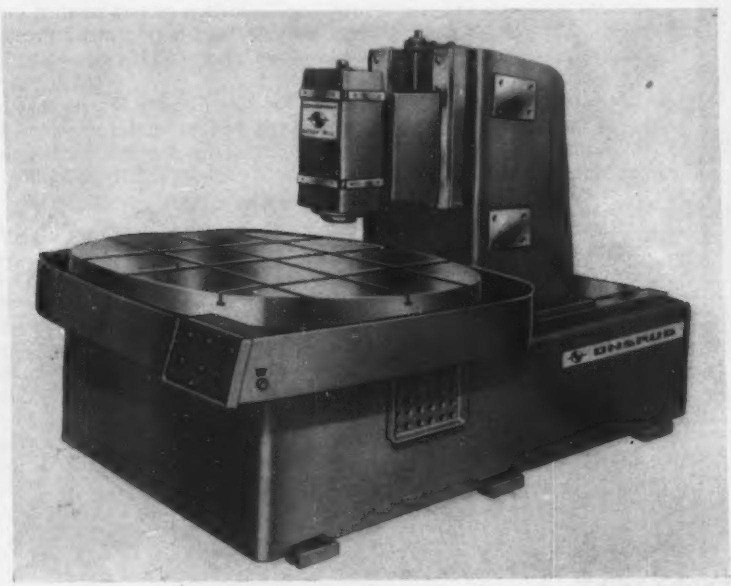
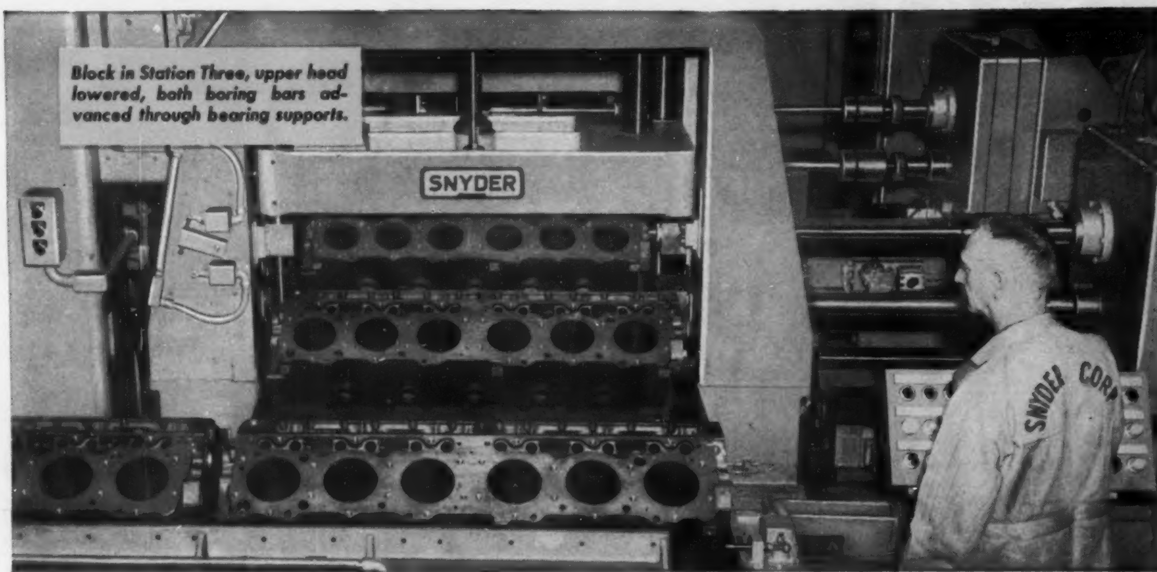
(This section continued on page 230)



Onsrud rotary-table milling machine designed to handle nonferrous work



PRECISION BORING OF 42" LENGTH CAM AND CRANKSHAFT HOLES

SNYDERIZING Meets the Demand for Quality Parts for the Soaring Sixties

This 12-cylinder block is for heavy duty truck and marine engines aimed at taking a bigger bite of this booming market. Our Snyder special 7-station machine is helping this manufacturer SNYDERIZE for the Soaring Sixties by providing boring tolerances which make his product outstanding.

In regular production at a rate of 31 pieces per hour, main and camshaft bearing holes are rough and semi-finish bored simultaneously with all diameters held to manufacturers' specifications for alignment, roundness and concentricity. The distributor hole is also semi-finish bored in this machine to establish proper location to cam and crank bores.

Advanced engineering, both in product and production machines, is the best possible preparation for the competition of the next decade. We'll be happy to show you, too, how to SNYDERIZE for the Soaring Sixties to gain more efficient parts handling, gaging, assembly and machining. Write or phone for new brochure on machines for profit improvement.

Standard Features of Snyder Machines

1. SNYDER UNITS equipped with hardened and ground steel ways.
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3. Automatic lubrication.
4. Walking beam transfer bar.
5. J.I.C. Standards throughout.
6. Electrical interlocks and full depth circuit throughout.
7. Panels equipped with SNYDER CIRCUIT SLEUTH.

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(Formerly Snyder Tool & Engineering Company)
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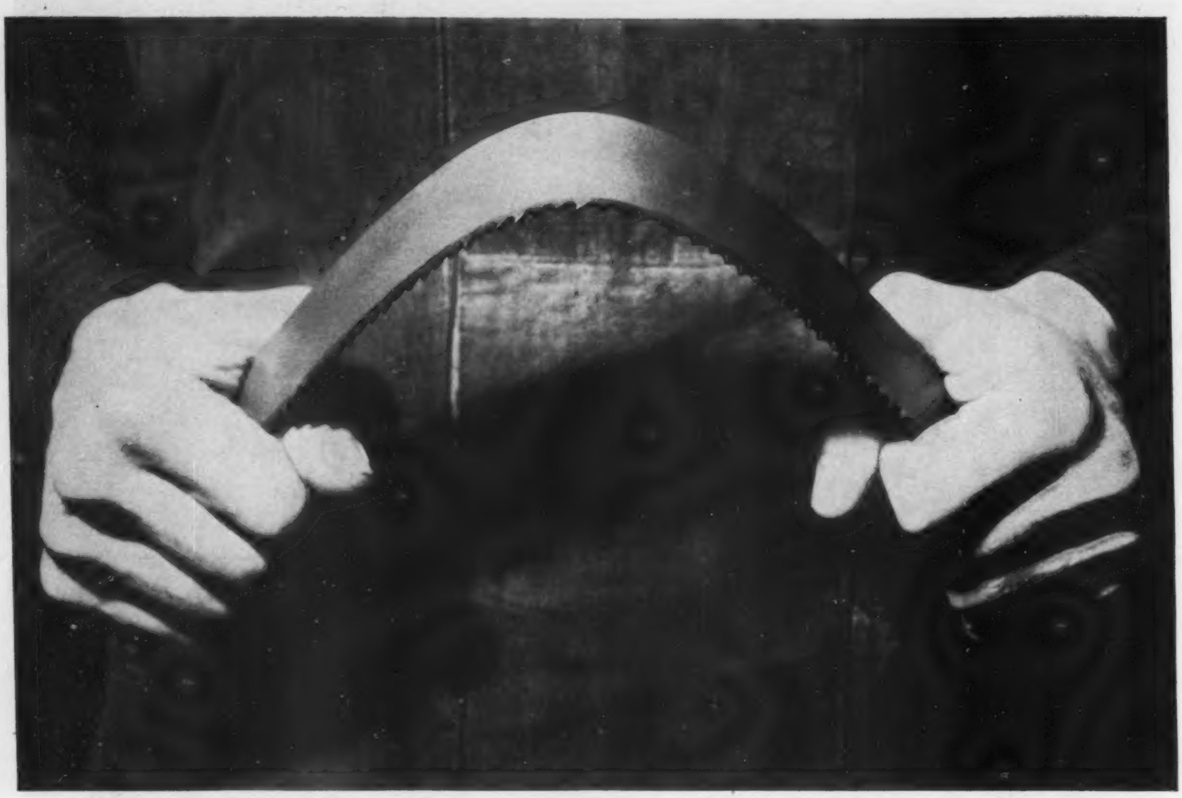
Phone: LO 7-0123



THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge. Development of this high-speed-edge blade made it possible to cut any kind of material from the free machining steels to the toughest of alloys, fast, accurately and economically. Just one type blade to handle any job — no switching blades to cut different materials. Like all good things, attempted copies of this blade have been numerous, but its performance has been *unequalled* by any of the imitators.

The MARVEL high-speed-edge hack saw blade can be tensioned from 200% to 300% tauter than any ordinary hack saw blade, a definite advantage which permits heavier feed pressures to be used without deflection or fear of breakage.

An extremely rugged cutting tool, this one type blade, the MARVEL High-Speed-Edge Hack Saw Blade, will cut any machineable metal with outstanding economy, accuracy, long life and complete safety—*it is unbreakable.*

Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

B-1120

Write for latest cutting tool Bulletin and the name of your nearest MARVEL Distributor

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NEW CATALOGUES

COUNTERS—Veeder-Root Inc., Hartford, Conn. Folder entitled "A Fresh Edge on Competition," describing the advantages to be gained by including counting devices in the design of machinery for manufacturers of machinery, appliances, instrumentation systems, and military equipment. The folder is available on letterhead request from the Sales Department, Veeder-Root Inc., 20 Sargeant St., Hartford 2, Conn.

VALVES—Parker-Hannifin Corporation, Parker Hydraulics Division, Cleveland, Ohio. Catalogue files 1553-A72 and A73, describing hydraulic control valves with nominal capacity of 150 gpm (gallons per minute) now being made by Parker Hydraulics Division for use on construction machinery and other heavy-duty mobile equipment. The valves are engineered to provide finely controlled metering characteristics in raising, positioning, rotating, holding, or lowering operations. They feature exceptionally low pressure drop. **501**

SURFACTANTS—Union Carbide Chemicals Co., Division of Union Carbide Corporation, New York City. 44-page booklet, describing the properties and uses of "Tergitol" surfactants. The booklet contains extensive data for eight nonionic and four anionic Tergitol surfactants, including selection, solubilities, properties, formulations, applications, performances, specifications and test methods, shipping, bulk storage, and physiological properties. A detailed bibliography and reference section is included. **502**

DRILLING—Brown & Sharpe Mfg. Co., Turret Drilling Division, East Norwalk, Conn. Booklet T-102, called "Drama in Drilling," presenting case histories of applications on their turret drilling machines. Applications include random hole patterns in one, two, and many planes, concentric bolt circles (flat surfaces and at different angles), and straight-line hole patterns with photographs of tooling and drawings of parts. **503**

COLD-FINISHED CARBON-STEEL BARS—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Revised bulletin giving information on additional types of leaded-steel bars including Ledloy 375, the fastest machining steel available. Stock sizes and shapes of more than twenty different kinds of cold-finished carbon-steel bars are shown, along with comparative data on strength, workability, machinability, and heat-treatment response, as well as cost. **504**

STARTERS—Cutler-Hammer Inc., Milwaukee, Wis. Folder (ED-30) covering company's complete line of nonreversing combination starters through NEMA Size 4. Data provided include descriptions, photos, and enclosure dimensions for all popular combination starters with either motor circuit switches or with circuit-breakers. **505**

BOLTS—Standard Pressed Steel Co., Jenkintown, Pa. Bulletin (Form 2527) offering complete data on a new line of aircraft bolts rated at 250,000 to 290,000 psi tensile strength—allegedly the world's strongest. Detailed performance data include graphs charting tensile and fatigue strength characteristics of the new fasteners—designated EWB 26—and other comparable aircraft bolts. **506**

GRINDING OF MILL ROLLS—Landis Tool Co., Waynesboro, Pa. Bulletin RG-59, giving the correct procedure for

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grinding the body of mill rolls, a highly controversial subject. This booklet contains information never before published on speeds, feed rates, traverse speeds, work speeds, wheel dressing, coolants, lubrication, conditioning, and the effects of hard- and soft-acting wheels. . . . 507

BLAST CLEANING—Pangborn Corporation, Hagerstown, Md. Bulletin No. 706, concerning small- to medium-size castings, forgings or heat-treated parts, molders of plastic forms, and reconditioners of brake shoes and other auto parts. It describes the exclusive features found in the standard-duty line of Rotoblast cleaning barrels from 1 ½- to 18-cubic-foot capacities. 508

VALVES—Hannifin Co., Des Plaines, Ill. Brochure describing the newly revised Hannifin "Valve Finder," now including minimum and maximum capacity coefficients (C_v) for the company's line of directional air control valves. The capacity coefficients (sometimes called flow factors) are calculated from laboratory measurements of actual air-flow rates through production valves. 509

GAS WELDING RODS—American Chain & Cable Co., Inc., Bridgeport, Conn. Bulletin DH-1277-B, describing rods which meet the requirements for fabricating ferrous metals and are produced to weld practically all metals of this class. The booklet gives complete information about each of the manufacturer's gas welding rods, analysis of the rod, recommended uses, welding procedure, and physical properties. 510

SERVO FACILITIES—Moog Servocontrols, Inc., East Aurora, N. Y. Facilities book showing the engineering and production facilities of the company's four plants and research laboratory. The book presents many items of unique and special equipment designed specifically for development and economical volume production of reliable precision electrohydraulic servo components. 511

DIE PROTECTION—Wintriss, Inc., New York City. Bulletin describing the "Circuit Master Mark III" overload detector that literally eliminates costly die damage due to overload misfeed, buckling, pile-up, end-of-material, or other malfunction. 512

HOSE AND FITTINGS—Weatherhead Co., Fort Wayne Division, Fort Wayne, Ind. 128-page catalogue presenting easy-to-find specifications, technical data, sizes, descriptions, applications, and installation instructions on the company's hose and hose assemblies, brass and steel tube fittings, hose and tube working tools, stock cabinets, etc. 513

CYLINDERS—Airmatic Valve, Inc., Cleveland, Ohio. Bulletin 91017 describing in detail the company's line of air, water, and oil cylinders and valve-cylinder combinations for today's automation applications. It also supplies specifications, ordering information, outstanding features, and dimensions. 514

FLAME PLATING—Linde Company, Division of Union Carbide Corporation, Indianapolis, Ind. Folder describing Linde's flame-plating process, Linde's controlled detonation process for applying thin, dense coatings to most metals to combine desirable base metal and coating properties. 515

ROLLER BEARINGS—Torrington Co., Torrington, Conn. Catalogue 359, presenting new HJ series roller bearings, featuring a patented one-piece cage design. The unique cage design permits use of the new bearings at speeds higher than possible with conventional full complement roller bearings. 516

FLUID-POWER EQUIPMENT—Oilgear Co., Milwaukee, Wis. Bulletin 10051-H, including specifications, illustrations, references, and descriptive matter on the complete line of the company's fluid-power standard equipment. Included in the listings of this equipment are: pumps, motors, transmissions, and cylinders. 517

TUBE-FITTINGS FINDER—Parker-Hannifin Corporation, Parker Fittings & Hose Divison, Cleveland, Ohio. Bulletin 43061, offering condensed information to help select proper fittings for various service and installation requirements. It includes shape charts for six types of industrial tube fittings and illustrations of tube-working tools. 518

HYDRAULIC MACHINES—Baker Brothers, Inc., Toledo, Ohio. Bulletin illustrating and describing a number of accessories which vary the standard cycles of hydraulic drilling and tapping machines. They are available for both vertical and horizontal models of Baker machines. 519

PAINTING—Ransburg Electro-Coating Corporation, Indianapolis, Ind. Brochure entitled "Spray Painting with the Electrostatic Hand Gun," presenting data on the principles and uses of the No. 2 Process Electrostatic hand gun, with six pages of pictures of actual production applications. 520

DIAMOND DRESSING—Wheel Trueing Tool Co., Detroit, Mich. Catalogue describing "Tru-Grit" engineered diamond-dressing tools, as well as a new "job data form" to enable Wheel Trueing engineers to show how money may be saved with Tru-Grit diamond tools designed to specific needs. 521

BEARING BLOCKS—Link-Belt Co., Chicago, Ill. Book 2707, giving full information on the company's complete line of babbitted, bronze, and plain-bore bearing blocks and takeups. The company announces the addition of 119 new sizes in eight series to its line. 522

SPEED REDUCERS—Ohio Gear Co., Cleveland, Ohio. 65-page catalogue covering new "Hi-Line" series speed reducers, supplementing the company's 186-page general catalogue on stock gears and speed reducers. It provides engineering data, dimensions, and applica-

tion selection charts on the new "Hi-Line" series fin- and fan-cooled reducers. **523**

PRESSES—Cleveland Crane & Engineering Co., Wickliffe, Ohio. Catalogue No. 2029-A, covering the new line of Steelweld speed-draw presses. Diagrams depict the unusual patented mechanism which provides an operating speed that is 80 per cent over that of standard mechanical presses. **524**

MEASURING—Scherr-Tumico, New York City. 96-page guide and catalogue entitled "Precision Measuring Tools and Instruments," featuring a complete line of measuring tools and toolroom specialties, optical measuring equipment, gear-hobbing and gear-testing machines, as well as Tumico precision measuring instruments. **525**

SWITCHING VALVES—Moog Servocontrols, Inc., East Aurora, N. Y. Product Bulletin 106, describing the operating principles, performance characteristics, and typical applications for the company's Series 19 acceleration switching servo valves. **526**

METALWORKING TOOLS—Whitney Metal Tool Co., Rockford, Ill. Two 1960 general catalogues, covering a complete line of metalworking tools, including the new rod cutter series and the new universal bending brakes, as well as punches and dies. **527**

HOT HEADING—H. M. Harper Co., Morton Grove, Ill. Booklet discussing hot working in metals, originally the blacksmith's art, but today an exact science by modern forging machines and precision-made high-quality tools at high production speeds. **528**

GLASSES—American Optical Co., Safety Products Division, Southbridge, Mass. Catalogue No. S-8582, covering the company's entire ultrasonic safety-glasses line, containing all data on the "Safemaster" mahogany, pink crystal, and metal frames. **529**

ULTRASONIC CLEANING—Oakite Products, Inc., New York City. Service Bulletin No. 16A, showing how alkaline and acidic detergents are frequently better for ultrasonic cleaning than the more viscous solvents. This is one of six practical tips given in the bulletin. **530**

CARBIDE ROUTER BIT—Sonnet Tool & Mfg. Co., Hawthorne, Calif. Folder describing the company's standard tungsten-carbide router bits for use on aluminum, plywood, acrylic plastics, Bakelite, resin-based plastics, stainless sheets, and fiber-base plastics. **531**

COMPARISON CHART—Peter A. Frasse & Co., Inc., New York City. Data Chart, Sec. A, No. 4, providing a comparison of properties for eighteen different grades of stainless steel, including the recently developed precipitation-hardening Grades 17-4 and 17-7. . . . . **532**

IN-LINE FILTER—Arrow Tools, Inc., Chicago, Ill. Bulletin No. 1L-605, describing a hydraulic in-line filter, applicable for either pressure or suction side of pump. It is constructed for thorough protection of hydraulic machinery and oil-recirculating equipment. **533**

OPTICAL ANALYSIS—Jones & Lamson Machine Co., Comparator Division, Springfield, Vt. Catalogue presenting diagrams and specifications, as well as a description of a new optical method for the inspection and analysis of fine-pitch involutes. **534**

WHEEL-FORMING ATTACHMENT—Pratt & Whitney Co., Inc., West Hartford, Conn. Brochure featuring Model 5 Diaform wheel-forming attachment for permanent mounting. It has the advantages of fast truing and increased accuracy. **535**

ALLOYS—Carpenter Steel Co., Alloy Tube Division, Union, N. J. Bulletin featuring tubing and pipe made of Hastelloy Alloys B and C. It outlines applications of these super corrosion-resistant alloys and describes their resistance to corrosive fluids. **536**

GRINDING OPERATIONS—Cincinnati Milling Products Division, Cincinnati Milling Machine Co., Cincinnati, Ohio. Catalogue entitled "Cincinnati Snagging Wheels" (PG-356), describing the features and proper selection of these wheels for swing-frame, floor-stand, and portable grinding. **537**

ALUMINUM—Bunting Brass & Bronze Co., Toledo, Ohio. Brochure entitled "The Technology of Bunting Bearing Aluminum Bars," describing aluminum bearing material now available in the form of tubular and solid bars. Economic advantages are listed. **538**

SLICING MACHINE—DoALL Co., Des Plaines, Ill. Circular describing the new Microtom-atic slicing machine Model MTA-7, which uses diamond wheels to produce thin, accurate slices of brittle materials at high, sustained production rates. **539**

THREAD CHASING—Jones & Lamson Machine Co., Machine Tool Division, Springfield, Vt. Catalogue describing J & L autothreader, which facilitates single-point thread chasing for J & L turret lathes with automatic cycle. **540**

PRESS BRAKES—Dreis & Krump Mfg. Co., Chicago, Ill. Bulletin No. S-59, featuring two light-duty models of mechanical press brakes—Model 131, 11-ton capacity, and Model 265, 25-ton capacity. **541**

TUBING—Jones & Laughlin Steel Corporation, Electricweld Tube Division, Pittsburgh, Pa. Circular giving specifications on "Jal-Smooth," a new drawn-over mandrel electricweld tube to meet critical requirements for cylinder tubing. . . . **542**

GRINDING WHEELS—Macklin Co., Jackson, Mich. Brochure discussing disc grinding wheels. It describes the desired char-

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acteristics of disc wheels and provides performance records on various disc grinding operations. 543

COLD-HEADING WIRE—Universal-Cyclops Steel Corporation, Bridgeville, Pa. Brochure describing stainless-steel cold-heading wire. It compares the cost, corrosion resistance, and cold-heading characteristics of the commonly used grades of this wire. 544

FURNACES—General Electric Co., Schenectady, N. Y. Bulletin GED-3991, containing illustrated descriptions of G-E's complete line of electric elevator furnaces for batch annealing of standard and pearlitic malleabe iron. 545

CARBIDE BURRS—Thomas C. Wilson, Inc., Long Island City, N. Y. Catalogue CB-59, describing a complete line of solid-carbide burrs for use with power hand tools and flexible-shaft machines for cutting metals, plastics, and other materials. 546

RECORDERS—General Electric Co., Schenectady, N. Y. Bulletin GEA-6933, providing buying information on a compete line of recording instruments, including dimensions and chart speeds, operating specifications, applications, features, and accessories. 547

DRILL HEAD—Cleveland Pneumatic Industries, Inc., Skokie, Ill. Leaflet describing heavy-duty multiple-spindle drill head. Designated as "Hercules," the Model 98-X is designed for extra-heavy duty and offers a drilling capacity greater than the standard Model 98 drill head. 548

SCREWDRIVER—Ingersoll-Rand Co., Phillipsburg, N. J. Folder featuring small, air-powered screwdriver designed to reduce exhaust noises to a whisper, called the "Cushionair" screwdriver. 549

BENDING MACHINES—Pines Engineering Co., Inc., Aurora, Ill. Circular presenting data on the seven standard models of the company's rotary type bending machines for tubing, pipe, extrusions, and rolled sections. 550

VALVES—Waterman Engineering Co., Evanston, Ill. Bulletin (A-300), illustrating cartridge style, pressure-compensated, hydraulic flow-regulating valves. . . 551

BAND SAW—Henry G. Thompson & Son Co., New Haven, Conn. Circular describing the company's Milband band saw, and outlining the advantages that band sawing with high-speed-steel band blades offers over other cutoff methods. . .552

CUTTING TOOLS—Precision Twist Drill & Machine Co., Crystal Lake, Ill. Catalogue describing taps and gages in addition to company's complete line of high-speed and carbide drills, reamers, and end mills. 553

BUS DUCTS—Bulldog Electric Products Division, I-T-E Circuit Breaker Co., Detroit, Mich. Folder describing "BUStribution" Duct, a duct and safety plug for the distribution of electrical current. 554

RATCHET WRENCHES—Lowell Wrench Co., Worcester, Mass. Catalogue No. 62, presenting a simplified method for figuring correct wrench size for any bolt or nut diameter. 555

PRESSES—A. B. Farquhar Division, The Oliver Corporation, York, Pa. Bulletin M-1000, describing the company's O.B.I. mechanical gap presses 556

VISES AND CHUCKS—L-W Chuck Co., Toledo, Ohio. Catalogue presenting vises, chucks, and dividing heads. 557

CHUCKS—Pratt & Whitney Co., Inc., West Hartford, Conn. Catalogue describing precision chucking devices which increase accuracy, meet almost any work size requirement, and speed work. . .558

FLEXIBLE SHAFT EQUIPMENT—Wyzenbeek & Staff, Inc., Chicago, Ill. Catalogue No. 59, featuring flexible shafts and drilling, filing, and polishing accessories. 559

SEAM WELDERS — Federal Machine & Welder Co., Warren, Ohio. Bulletin S-59, describing a new line of seam welders. 560

DRILL POINTING—Winslow Product Engineering Corporation, Arcadia, Calif. Brochure describing the Model 100 Winslo-matic drill pointer which produces helical, split point, or conventional points. 561

MICROMETERS—J. T. Slocomb Co., South Glastonbury, Conn. Brochure fully illustrating representative groupings of the complete line of the company's micrometers. 562

COLLETS—Benco Collet Mfg. Co., Cleveland, Ohio. Catalogue 59, illustrating and describing its line of collets, pushers, feed fingers, and pads for all types of screw machines as well as lathe collets. . .563

CLUTCHES—Pic Design Corporation, East Rockaway, N. Y. Booklet entitled "Magnetic Clutches and Their Applications." It has complete details on design and applications, as well as technical and testing specifications. 564

PRECISION BALLS—Hartford Steel Ball Co., West Hartford, Conn. Catalogue featuring precision balls and related bearing products. Included are the new AFBMA ball standards. 565

DRILL—Chicago-Latrobe, Chicago, Ill. Folder describing the company's "Lo-Tork" chip-breaker drill. 566

BAND-SAW BLADES—Capewell Mfg. Co., Hartford, Conn. Bulletin featuring L-100-M "Speed-Band," a new concept in band-saw blades. 567

This card expires March 1, 1960

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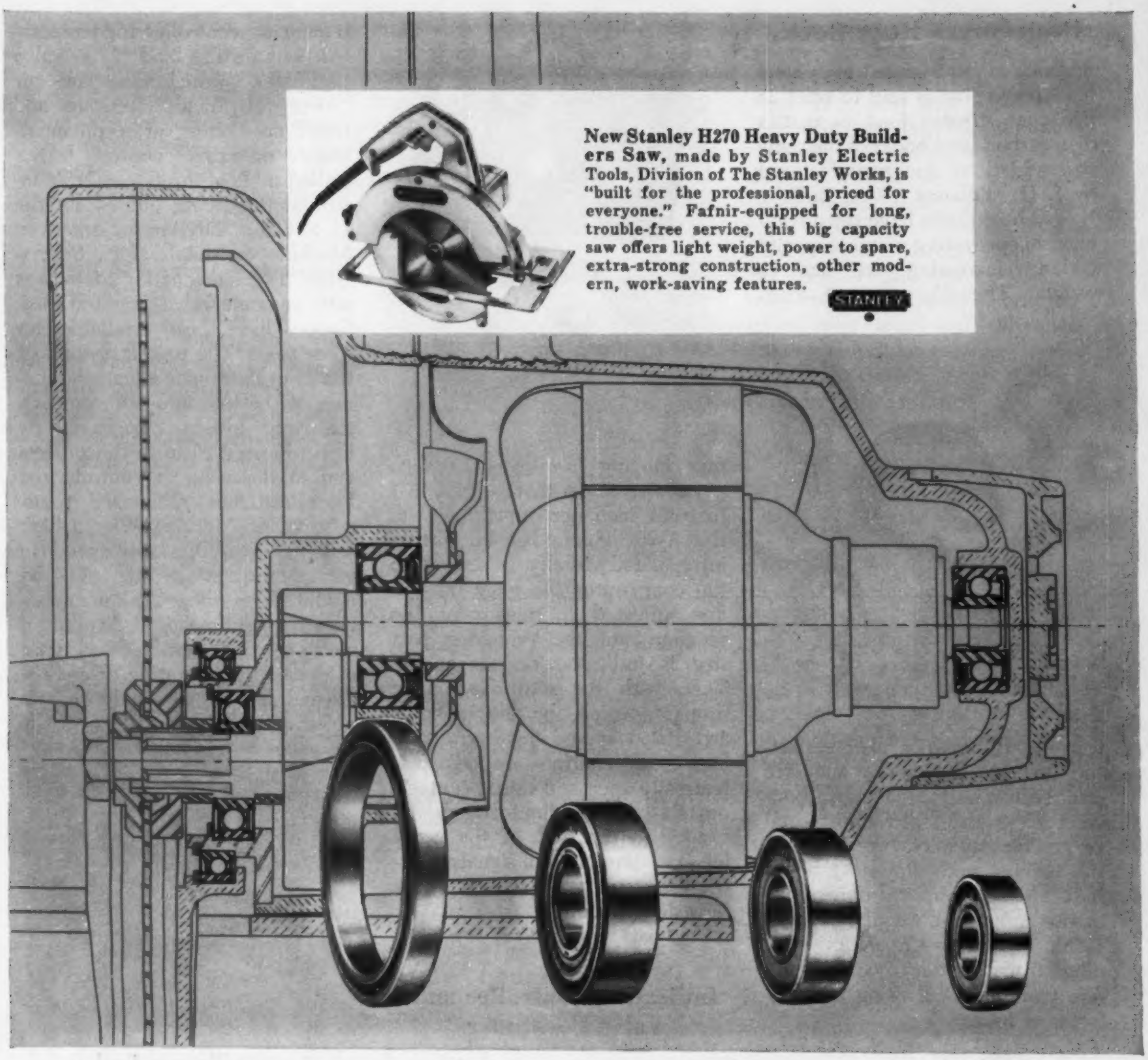


New Stanley power saw, Fafnir ball bearing equipped, designed to deliver nearly 40% more cutting force!

Armature, saw shaft, even the blade guard Fafnir-mounted for free-starting, no-maintenance, heavy-duty performance

Nearly 40% more cutting force at working speeds, with 27% less operator effort! This new Stanley power saw represents a design achievement of the first order. And to insure long, efficient service life, Stanley makes generous use of Fafnir precision ball bearings. Even the blade guard is Fafnir-equipped (with an aircraft type bearing), for responsive action at the slightest pressure. On the armature and saw shaft, Fafnir ball bearings all but eliminate friction and wear. Bearing maintenance is eliminated, too. Various combinations of seals and shields lock out contaminants, lock in factory-packed lubricant. No danger of faulty or neglected lubrication... virtually no chance of bearing failure.

Take advantage of Fafnir's "designer's approach" to bearing problems. You'll find Fafnir's breadth of experience and diversity of line insure precise answers. Write The Fafnir Bearing Company, New Britain, Connecticut.

Sealed and shielded Fafnir ball bearings meet specific service requirements in Stanley saws

Felt seal and shield (Motor Armature)

2 Plya-Seals (Blade Guard)

Plya-Seal and shield (Saw Shaft)

FAFNIR
BALL BEARINGS

For more data, circle this page number on inquiry card

Drop-Forged Hoist Hooks

A series of drop-forged alloy-steel hoist hooks that is said to offer 25 per cent greater load capacities than carbon-steel hooks of the same size added to line manufactured by J. H. Williams & Co., Buffalo, N. Y. These hooks have the advantage of providing extra capacity without increasing the size or weight. The 25 per cent load-

capacity differential also permits the use of alloy hooks one size smaller than corresponding carbon-steel hooks and still retains equal or greater capacity. Size for size, the carbon- and alloy-steel hooks have identical physical dimensions in the safety and regular, eye or shank patterns. Capacities now range from 3/4 ton to 68 3/4 tons safe working load, using a safety factor of four.

Circle Item 611 on postcard, page 225

RCA Limit-Signalling Comparator

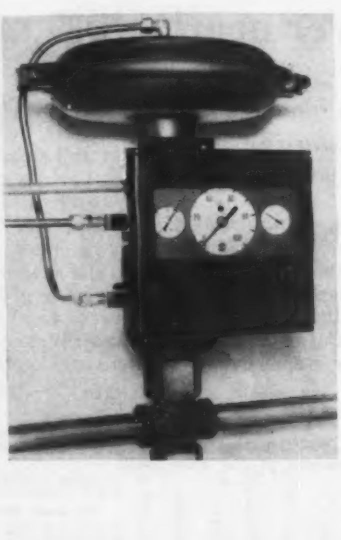
Limit-signalling comparator, Model 765, with piston gaging attachment introduced by the Radio Corporation of America, Industrial and Automation Division, Detroit, Mich. This precision instrument is designed for receiving and small-lot inspection, or spot checking of production runs. It can be used with standard-height stands or special fixtures for manual inspection or for automatic in-process or post-process gaging and segregation. An RCA standard air-electronic kit is also available for adapting the LSC for air gaging. Nine different gage heads are available, permitting direct read-

ings ranging from 0.000050 inch per dimension with the Type A-1 to 0.001 inch per dimension with the A-20. These can be further interpolated visually. In setting up the comparator the gage head is first adjusted by means of the vernier until the reference part size is indicated on the meter. Then with the setup switch in proper position, the desired limits are dialed in and the coarse and fine signal controls are adjusted. Normally open and closed contacts operated by the limit signals are located at the back of the panel for operating audible signals, electric counters, and reject gates, or for machine control.

Circle Item 612 on postcard, page 225

Indicating Controller and Valve Positioner

Two-in-one instrument that combines, in one valve-mounted unit, the functions of (1) an indicating



pneumatic controller for temperature or pressure, and (2) a "valve positioner," which amplifies air power to provide accurate and rapid positioning of a pneumatically operated control valve. Called a "Pilot-Positioner," this instrument is being offered by the U. S. Gauge Division of American Machine & Metals, Inc., Sellersville, Pa. Pneumatic controllers with separate valve-mounted positioners have been available for some years. The unique feature of the Pilot-Positioner is its combination of the two into one compact, relatively low-cost package. By being located close to the process and to the valve it controls, the Pilot-Positioner minimizes transmission lags and provides a high order of precision and speed in valve positioning. It can be mounted by the valve manufacturer on most makes of diaphragm motor valve, or certain other types of pneumatic operating or control devices and requires only one air supply.

Circle Item 613 on postcard, page 225

Sonnet Turret Lathe Tool-Holder

Sonnet "Tru-Align" turret lathe tool-holder that corrects for both radial and angular misalignment between the center line of spindle and the center line of the turret holder made by Sonnet Tool & Mfg. Co., Hawthorne, Calif. It is designed to feed the tool into the work in perfect alignment with the spindle. Unlike floating tool-holders, the "Tru-Align" locks the tool in position once true center alignment between turret and spindle is established. No further adjustment is required. The "Tru-Align" holder was designed primarily for close-tolerance finishing operations, such as counter-boring, step reaming, tapping,

chasing, reaming, etc. Outside diameter of the shank and bore of the tool-holder are precision ground to assure proper positioning in the turret. Made in a variety of sizes to fit most of the popular makes of turret lathes.

Circle Item 614 on postcard, page 225

Brown & Sharpe Vernier Depth Gage

Vernier depth gage No. 601 brought out by the Brown & Sharpe Mfg. Co., Providence, R. I. This gage has a dull chromium finish with jet-black graduations. A long vernier plate provides easy

readings in 0.001-inch graduations. The vernier graduations are flush with the blade graduations, thus eliminating parallax. A spring pressure clamp normally holds the blade so that it slides freely to the measuring position. Available with 6-, 12-, and both 6- and 12-inch blades which provide readings over the full range of 6 and 12 inches. The base is 2 5/8 inches wide. Furnished with or without case.

Circle Item 615 on postcard, page 225

Maxwell "Throway" Carbide Insert Tool-Holder

Universal-positioning "Throway" carbide tool-holder made by Maxwell Industries, Inc., Ashtabula, Ohio. This tool-holder is provided with Maxwell's locking insert and adjustable chip-breaker which adapt it for wider use with triangular and diamond-shaped carbide inserts. It is designed to combine the economy of carbide throw-away inserts with the advantages of universal positioning for all metal-turning and shaping operations. The universal-positioning

feature eliminates the need for several fixed-angle holders of different sizes. Instead of removing the holder from the machine, only the cap and locking insert are loosened, the carbide insert indexed, and the cap and locking insert retightened to position the insert at any desired angle. The holder remains on center with respect to the work-piece.

Circle Item 616 on postcard, page 225

"Kwik-Chek" Dial Comparator

Dial comparator, one of five new gages added to the "Kwik-Chek" line of precision measuring instruments offered by the Industrial Division, Hamilton Watch Co., Lancaster, Pa. In addition to the

dial comparator shown, this line includes horizontal-jaw gage, horizontal micrometer gage, recess-depth gage, and small-bore gage. Specially designed for miniature work, the Kwik-Chek line now includes tools that permit rapid gaging of bores, recesses, grooves, and many other dimensions to an accuracy within 0.00005 inch. The "Micro Dial" indicator on each of the new gages is jeweled, and features both zero and tolerance-pointer adjustments. On special order it is possible to obtain metric dials and a large variety of custom features.

Circle Item 617 on postcard, page 225

Full-Floating Tool-Holder

"Tool-Flex" full-floating tool-holder designed to fill an important requirement in making tooling setups on such equipment as drilling, counterboring, spot facing, reaming, and tapping machines, and open-side boring mills. Manufactured by the Burgmaster Corporation, Gardena, Calif., it automatically compensates for parallel and angular machine-spindle misalignment. It is simple in construction, embodying only four main parts. The collet is mounted in shock-absorbing neoprene rubber which permits full-floating action for both parallel and angular machine-spin-

dle misalignment. The amount of float desired can be adjusted by varying the pressure on the neoprene retaining ring. A full line of sizes and types of Tool-Flex holders is available. Special holders have been built up to 26 inches long and weighing 140 pounds with a No. 16 taper-shank drive for use on a horizontal boring mill for driving boring-bars.

Circle Item 618 on postcard, page 225

Between Grinds

E. S. Salichs

Dear Moon Men:

This is by way of briefing you on a wonderful earth tradition too important to be swallowed up in a planetary melee. We earth men call it the "Yuletide Season" and it brings out the very best in us—a spirit of good will, fellowship, and kindliness prevails throughout our world. It is our custom to wish our friends the best of everything for the coming year, and so we start this page with A Very Merry Christmas and A Most Happy New Year from MACHINERY to all our readers!

Shine vs Pine

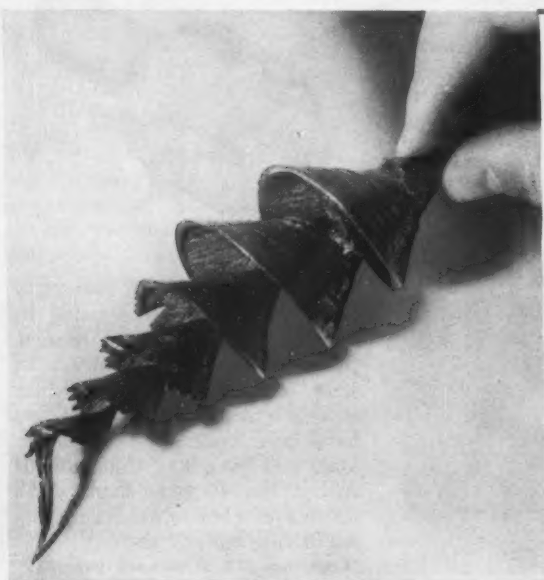
Glittering trees of aluminum (fireproof, nontarnishing, and lasting) will be standing in many homes this Christmas. The trees are made of Reynolds aluminum and come in kit form. All you have to do is insert the branches into pre-drilled "trunks." You can't read directions—you have a funny-looking tree. Maybe you would in any case.

The Tick of the Tube

A 30-pound atomic clock that looks like a foot-long electron tube is now under construction at the Hughes Aircraft Co., and is expected to provide "the most precise check in the history of the world on the effects of gravity on atomic processes." Dr. Harold Lyons, its inventor, has explained that the clock would "recheck Einstein's special law of relativity which sets forth the famous 'twin paradox' – the orbited clock would return 'younger' than its counterpart on Earth and if a human twin could be launched with the clock, he would return younger than his brother who stayed home." We always said, don't hang around the house.

Meticulous Missiles

The Army was dissatisfied with existing commercial type vacuum cleaners for cleaning the complicated electronic devices in its Nike Ajax, Nike Hercules, Corporal, and Sergeant missile systems. So the U. S. Army Engineer Research and Development Laboratories came to the rescue and developed two vacuum cleaners that would meet military requirements, such as being operable on the type of power available at missile sites and having attachments made of nonconductive material to prevent shocks.



CHIP-TEASE—An eye-opener is the chip here illustrated, one of several hundred made with a 3-inch, high-speed-steel twist drill driven at 0.100-inch feed in mild steel by a Cincinnati Bickford 19-inch column Chipmaster radial drill. The chips were made to demonstrate the rigidity, power, and thrust capacity of the Chipmaster line of radials recently redesigned by Giddings & Lewis Machine Tool Co.

Specify the

T-J Spacemaker

for longer, more efficient cylinder service

You too—can reduce replacement expenditures—lower maintenance costs with the T-J Spacemaker cylinder line. Designed and engineered for ruggedness, and accuracy of operation, the Spacemaker assures longer, uninterrupted operation.

The T-J Spacemaker eliminates tie-rods, gives greater strength, saves space . . . and reduces costs in all push-pull operations. Immediate delivery in a complete range of styles and capacities . . . air or oil. Write for Bulletin SM 155-4, today. The Tomkins-Johnson Company, Jackson, Michigan.

With Extras . . . At No Extra Cost

1. METAL PISTON ROD SCRAPER—protects rod packing, cylinder bore and rod surface by removing all foreign particles.
2. NEW "SUPER" CUSHION for air or METALLIC SELF-ALIGNING MASTER CUSHION for oil.
3. HARD CHROME PLATED CYLINDER BORES AND PISTON RODS for greater protection and reduced wear.
4. ONE PIECE PISTON assures better alignment, longer bearing and packing life.
5. FORGED SOLID STEEL HEADS throughout entire line.
6. PILOTED PACKING GLAND with extra long bearing for additional strength and support to piston rod.
7. NO TIE-RODS TO STRETCH—gives you 360° port rotation . . . less space used . . . full strength.
8. STREAMLINED DESIGN . . . operating pressures to 200 PSI, air; 1,000 PSI oil, non-shock.

T-J TOMKINS-JOHNSON
RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

For more data, circle this page number on inquiry card

News OF THE INDUSTRY

California

Hughes Aircraft Co., Culver City, Calif., announces that Iden F. Richardson has been appointed manager of Hughes Products Group, the commercial division of the company. Mr. Richardson succeeds Raymond B. Parkhurst, who now resumes his former post of vice-president–manufacturing.

Union Twist Drill Co., Athol, Mass., and S. W. Card Division, Mansfield, Mass., announce the appointment of Murray Industrial Supply Co., Sacramento, Calif., as one of their authorized distributors.

Dr. Lloyd P. Smith has joined Aeronutronic, a division of Ford Motor Co., Newport Beach, Calif., as director of research operations.

Illinois

Wallace Supplies Mfg. Co., Chicago, Ill., announces that the following dealers will handle its line of bending machines and abrasive cutting units:

In the Portland, Ore., normal trade area: Allied North West Machine Tool Corporation, 1222 S. E. 7th Ave., Portland 14, Ore.

In the Seattle normal trade area: Perine Machinery & Supply Co., 1921 First Ave. S., Seattle 4, Wash.

On the West Coast: Harley-Pence Machinery Co., 1805 N. Hillhurst Ave., Los Angeles 27, Calif.; Machinery Sales Co., 2838 Leonis Blvd., Los Angeles 58, Calif.; M. M. Thackaberry, Inc., 1300 S. Soto St., Los Angeles 28, Calif.

In the Cleveland normal trade area: Cleveland Duplex Machinery, 1495 Warren Road, Lakewood 7, Ohio.

In central Michigan: Lakeshore Machinery & Supply Co., 400 W. Laketon Ave., Muskegon, Mich.

In the Pittsburgh normal trade area: Leonard R. Nourie, Inc., 2414 W. Liberty Ave., Pittsburgh 26, Pa.

In eastern Pennsylvania, southern New Jersey, Maryland, and Delaware: Edward A. Lynch Machinery Co., 29 E. Wynnewood Road, Wynnewood, Pa.

Clearing Division of U. S. Industries, Inc., Chicago, Ill., has named Eugene P. Cunningham senior vice-president. Mr. Cunningham has been with the Clearing organization since 1934, when he joined the engineering department. He has progressed steadily to his present position. Ralph Leonard has been appointed sales engineer to handle Clearing lathes in Philadelphia and the Eastern Seaboard.

Eugene P. Cunningham, new senior vice-president, Clearing Division, U. S. Industries, Inc.

Crane Packing Co., Morton Grove, Ill., has just completed the first plant devoted exclusively to the full scale processing of Du Pont Teflon—a postwar plastic material that has done much to further major advancements in rocket and missile, aviation, electronic, and chemical industries.

Kropp Forge Co., Chicago, Ill., announces that Raymond T. O'Keefe, Jr., executive vice-president and treasurer of the company, has been elected chairman of the board to succeed Roy A. Kropp, who retired last week.

Paul W. Christensen, Jr., president, National Metal Trades Association

National Metal Trades Association, Chicago, Ill., elected Paul W. Christensen, Jr., president of the Cincinnati Gear Co., president at its annual meeting in Providence, R. I. Long active in the association, he is just completing a two-year term as treasurer.

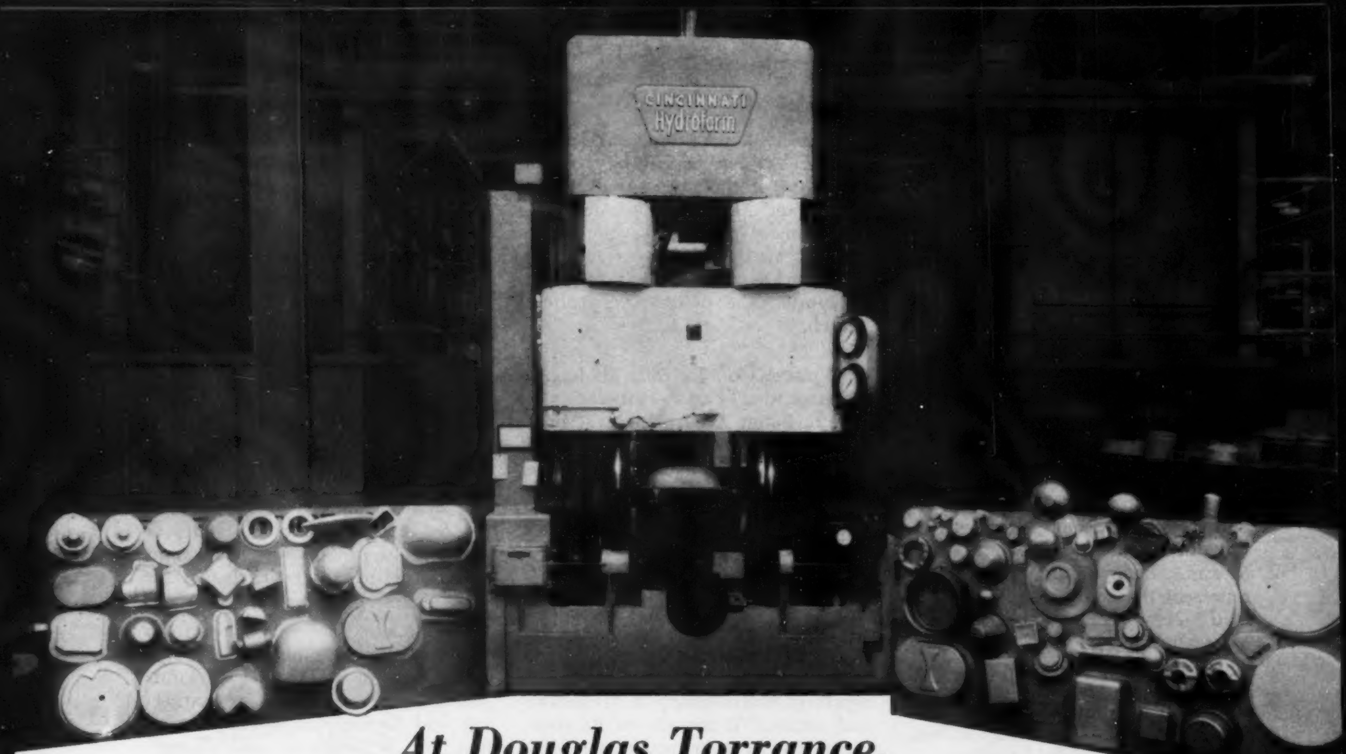
Aurora Pump Division, the New York Air Brake Co., Aurora, Ill., announces the appointment of Raoul D. Elder as division sales manager. He succeeds John M. Bals, general manager.

Bill Johnson has been named New England representative of the Cutting Tool & Gage Division of Besly-Welles Corporation, South Beloit, Ill.

Hans W. Deutsch has been appointed manager of the Special Products Division, Scully-Jones & Co., Chicago, Ill.

Michigan and Indiana

Howell Electric Motors Co., Howell, Mich., has acquired the Leland Electric Co., a former division of American Machine & Foundry. Leland, a major manufacturer of 1200 different specifications



At Douglas Torrance, the major source for sheet metal draw work is the Cincinnati Hydroform

The state of Hydroforming art at the Torrance facility of Douglas Aircraft Co., Inc., El Segundo Div., has progressed to the point that their 26″ Hydroform® is the major source for sheet metal draw work. The photo above shows their Hydroform, surrounded by display panels of typical parts produced. These display panels are kept at the machine site for the edification of visiting tooling and methods engineers. Note the variety of complex shapes and the extreme range of part sizes, all produced on this machine.

Many parts formerly fabricated by welding and hand finishing, or produced by drop hammer, conventional deep drawing, or spinning, are now Hydroformed complete in one or two draws. Improved part quality, and incalculable savings in tooling and labor costs, scrap loss and production time have resulted.

Look into the many advantages offered by Hydroforming for producing your sheet metal parts and components. For full information, call in a Meta-Dynamics Division field engineer.

Hydroform
META-DYNAMICS DIVISION
Machines for Metal Forming and Heat Treating

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

CINCINNATI

Small shapes are drawn on the 26″ Hydroform at Torrance, by using the ingenious multiple punch and draw ring set shown below. This tooling is used for the simultaneous forming of up to four parts, or for the production of unusually small parts. The main draw ring (Fig. 1) will accept insert-type draw rings, and punches up to 3″, 4″, 5″ and 6″ in diameter. Fig. 2 shows a right-hand and left-hand part punch, and draw ring, ready for insertion in the tool set. Tools can be changed in two minutes. Fig. 3 shows the parts produced.

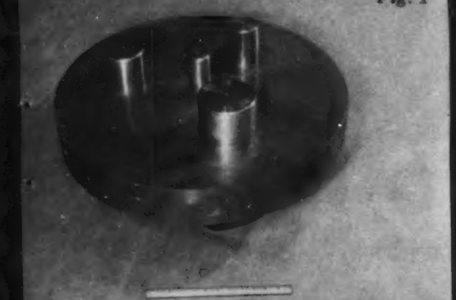


Fig. 1


Fig. 2


Fig. 3

of electric motors, including the explosion-proof types and generators, now gives Howell three wholly owned operating subsidiaries and four manufacturing plants. Manufacturing operations will continue at the leased 180,000-square-foot Dayton, Ohio, plant. Leland employs about 500 people. There will be no immediate changes in the personnel structure nor in the operation of the Howell subsidiary.

Michigan Tool Co., Detroit, Mich., announces the appointments of L. W. Sheehy, J. C. McFarlin, and H. B. Gaumond to represent the firm in the New England states. Messrs. Sheehy and McFarlin will represent the company in Rhode Island, New Hampshire, Vermont, Massachusetts, southeastern Maine, and eastern Connecticut. Mr. Gaumond will represent Michigan Tool in western Connecticut, including Hartford, Litchfield, New Haven, Middlesex, and Fairfield Counties.

Glen O. Corbett has been named southwestern field service manager for the Industrial Controls Section, Bendix Aviation Corporation, Detroit, Mich. Mr. Corbett is located at 10812 Woodland N. E., Albuquerque, N. M., and will provide liaison service and technical assistance to users of Bendix numerical-control systems in Albuquerque; Boulder, Colo.; Kansas City, Mo.; and Amarillo, Houston, Dallas, and Fort Worth, Tex.

National Electric Welding Machines Co., Bay City, Mich., announces two personnel promotions, marking the expansion of its development section. Paul Thorne has been named chief electrical and development engineer. Harold Bach, former manager of the service and research section, has been named chief welding engineer. Mr. Bach will remain in charge of service and test and has been given additional responsibility as consultant liaison between engineering and test.

William W. Wellborn has been appointed vice-president and director of research and development of the Abrasive Dressing Tool Co., Detroit, Mich.

Henry V. Shrope has been appointed as a service engineer in Michigan, Indiana, and Kentucky for Wesson Co., Ferndale, Mich.

Formsprag Co., Warren (Detroit), Mich., has purchased the Rawson Division of the O. S. Walker Co., Worcester, Mass., and is completing the transfer of the operation to its Detroit area plant this week. The Rawson Division has been the manufacturer of a patented centrifugal clutch.

Wesson Co., Detroit, Mich., announces that Flack-Pennell Co., 320 S. Baum Ave., Saginaw, Mich., has been appointed as the stocking distributor for the lower peninsula of Michigan, north from a line between Flint and Grand Rapids. The new distributor will have stocks of all lines of Wesson cutting tools and carbides.

George A. Soule has been appointed sales engineer by the Michigan Tool Co., Detroit, Mich., to represent the company in Minnesota and western Wisconsin on its complete line of gear production machines, tools, and checking equipment.

Robert L. Deneau has been added to the direct-sales staff at Buhr Machine Tool Co., Ann Arbor, Mich. Mr. Deneau will serve on special assignments out of the firm's Ann Arbor offices.

L. C. Lucas has been appointed district sales manager of the Grand Rapids, Mich., territory of the Mueller Brass Co., Port Huron, Mich.

Special Engineering Service, Inc., is now located in its new sales and engineering headquarters at 7630 Wyoming, Dearborn, Mich.

National Automatic Tool Co., Inc., Richmond, Ind., announces the appointment of several new distributors for its line of Natco 12- to 80-ounce capacity injection molding machines. Portland Machinery Co., Portland, Ore., will be responsible for sales in the states of Oregon, Idaho, and Washington. Overgard Machine Tool Co., Denver, Colo., will sell Natcos in Colorado, Montana, New Mexico, and Wyoming. Price Equipment Co., Monroe, N. C., has sales responsibility in Georgia, North Carolina, South Carolina, Tennessee, and Virginia. Randolph G. Milnes Co., Willow Grove, Pa., sales territory includes the states of Delaware, southern New Jersey, and the eastern half of Pennsylvania.

Wheelabrator Corporation, Mishawaka, Ind., announces the appointments of Frederick J. Pichard as assistant director of marketing and Donald A. Swardson as manager of abrasive and "Long-Lyfe" parts sales. Mr. Pichard's initial responsibility will be to develop special marketing programs in keeping with the company's plans for expansion.

New England

Pratt & Whitney Co., Inc., West Hartford, Conn., announces that Edward J. Ferris, Jr., has been named factory manager and Earl R. Lewis, Jr., production manager. Mr. Ferris will be responsible for coordinating all manufacturing operations and Mr. Lewis, for all production-department activities within the company's machine tool, cutting-tool, and gage divisions.

(Left) Earl R. Lewis, Jr., production manager and (right) Edward J. Ferris, Jr., factory manager, Pratt & Whitney Co., Inc.

Johnson's Cold Stream stops rust—resists rancidity—reduces causes of dermatitis. These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you <u>all</u> the performance you pay for. **JOHNSON'S WAX**

cold stream

For information, see your local Johnson industrial distributor.

"Cold Stream" and "Johnson's" are trademarks of S. C. Johnson & Son, Inc., Racine, Wis.

PRODUCTO MACHINE Co., Bridgeport, Conn., announces the promotions of two sales executives. J. BRANDON SHAW has become eastern sales manager, with headquarters in the company's main offices in Bridgeport. DAVID S. HODGSON, Producto's Rochester, N. Y., branch manager since 1954, is now distributor sales manager, with headquarters in the main plant at Bridgeport. The promotions of two branch managers have also been announced. WILLIAM F. MCCALLION, employed in sales at the company's Philadelphia assembly plant since he joined Producto in 1955, has been named branch manager. DONALD L. WOLFROM, sales representative in the upstate New York area for the past two years, has become branch manager of Producto's Rochester assembly facilities.

NORTON Co., Worcester, Mass., announces that GEORGE A. PARK has retired as sales manager of abrasives at the company after a business career of fifty years. On the completion of forty years of service, Mr. Park was presented a certificate by the Grinding Wheel Institute in recognition of his years of devoted service. Changes in Norton Co.'s field sales organization have brought territory changes to seven men. RICHARD H. MERCHANT, formerly abrasive engineer in the Flint, Mich., area, has been assigned to the Baltimore area. FRANK W. KROHN will succeed Mr. Merchant at Flint. GEORGE C. CROOKS becomes the abrasive engineer for the New Orleans area. He succeeds HOMER L. GIBBS, who will now cover the Florida territory. ROBERT H. JOHNSON, formerly of Florida, has been reassigned to Philadelphia. On the West Coast, RONALD L. JANDRON, formerly abrasive engineer in the Los Angeles area, is now abrasive engineer in the Seattle, Wash., area. He succeeds ARTHUR W. COX, who retired September 30. K. DALE SWANSON, field engineer at Los Angeles since last spring, continues in that position, but now assumes some of Mr. Jandron's former responsibilities.

CIRCULAR TOOL Co., Providence, R. I., announces the appointment of DONALD MCINTIRE and of BRANCH-MERWIN TOOL SPECIALISTS as its representatives. Mr. McIntire will be in charge of Circular Tool Co. sales distribution in the state of Indiana. His activities will be based at 5129 W. 12th St., Speedway 24, Ind. Branch-Merwin Tool Specialists will represent Circular Tool Co. in the four-state area of Tennessee, Alabama, Mississippi, and Arkansas. W. B. Branch and C. W. Merwin, principals of Branch-Merwin, have headquarters at 477 North Bellevue, Memphis 5, Tenn.

BROWN & SHARPE MFG. Co., Providence, R. I., announces the following appointments: JOSEPH E. KOCHHAN has been named assistant general sales manager of the Industrial Products Division. He was formerly director of systems and audits under the direction of the vice-president and treasurer. RAYMOND H. MASSIE will assume duties as director of systems under the vice-president and treasurer. He was formerly Mr. Kochhan's assistant. AXEL CHRISTENSEN has been named sales manager, Brown & Sharpe Ltd. He reported for his new assignment in Plymouth, England, on November 3rd. He was formerly international machine tool representative stationed in Providence. MILLER C. BARNEY will succeed Mr. Christensen as international machine tool representative and will remain in Providence.

Lena J. Hopkins, president and treasurer, Circular Tool Co.

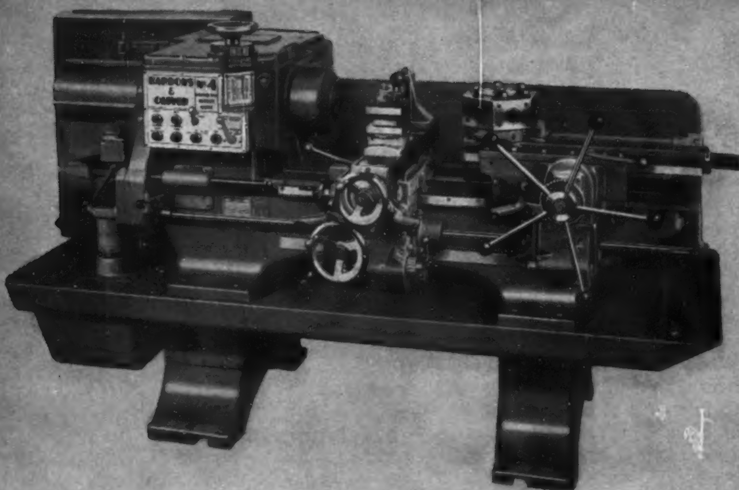
LENA J. HOPKINS, president and treasurer of the Circular Tool Co., Inc., Providence, R. I., has been honored by Brown University as one of twenty Rhode Islanders who have distinguished themselves through "service to Providence, to Rhode Island, and to the nation."

New York

THE CARBORUNDUM Co.'s Bonded Abrasives Division, Niagara Falls, N. Y., has announced a series of promotions effective January 1, 1960. P. R. JUNOD, salesman in the Buffalo district, will become Philadelphia district sales manager. E. A. JAPELY, salesman in the San Francisco district, will become sales man-




(Left to right) Joseph E. Kochhan, assistant general sales manager; Raymond H. Massie, director of systems and audits; Miller C. Barney, international machine tool representative, Brown & Sharpe Mfg. Co.; and Axel Christensen, sales manager, Brown & Sharpe Ltd., England



RAM TYPE TURRET LATHES		
Size	Bar Capacity	Swing Over Bed
No. 1 Geared Electric	5/8" or 13/16"	11-1/2"
No. 2 Geared Electric	1" or 1-1/4"	13-1/2"
No. 3 Universal	1-1/2" or 2"	15-1/2"
No. 4 Universal	2" or 2-1/2"	18-1/4"
No. 7 Universal	2-1/2", 3" or 4-1/2"	21-1/2"
SADDLE TYPE TURRET LATHE		
No. 21 Universal	2-1/2", 3" or 4-1/2"	21-1/4"

BARDONS & OLIVER

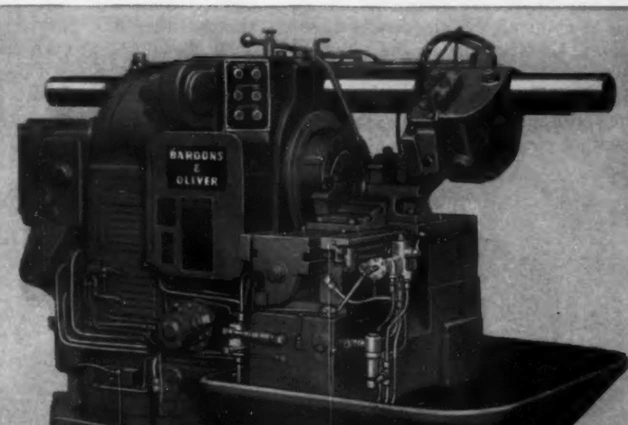
Turret Lathes ....

Each of the six Turret Lathes listed is a completely different machine, designed specifically for one range of work. All units on each machine, including the cross slide and carriage, and the turret slide and saddle, are "sized" for a particular work range. Thus adequate strength and rigidity is provided, maximum productive capacity is offered, and at the same time minimum operator effort is required. A complete line of tooling and attachments is available for each size of machine.

Cutting-Off Lathes

The Cutting-Off Lathes are designed to chamfer, form and cut off pipe, tubing, or bar stock with maximum efficiency. The number of pieces produced per hour often equals or exceeds that of much more expensive and complicated multiple spindle machines. Automatic loading tables, chamfer attachments, forming attachments, and automatic unloading devices are available for all sizes of Cutting-Off Lathes. These lathes are built as fully automatic, semi-automatic or hand operated.

CUTTING-OFF LATHES	
Size	Capacity
No. 32	2"
No. 33 and 34	3", 4" and 4-1/2"
No. 35 and 36	5-1/2" and 6-5/8"
No. 38 and 39	8-5/8" and 9-5/8"
No. 312 and 314	12-3/4" and 14"
No. 316	16"



BARDONS & OLIVER

BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes

ager of Area "A," Chicago district. M. M. CRAFT, presently field sales engineer in Los Angeles, will become sales manager of the Los Angeles sales district. F. J. BLAKE will continue as sales manager of the San Francisco district. In addition, Mr. Blake will be responsible for Bonded, Coated, Electro Minerals, and Merchandising Division sales in Alaska and Hawaii. After thirty-three years of service, F. C. GUEST, Detroit district sales manager, retired and is succeeded by K. H. WISBY, formerly assistant sales manager of the Detroit district.

BABCOCK & WILCOX BOILER DIVISION, New York City, announces that J. P. CRAVEN has been elected a vice-president of the company and placed in charge of the Boiler Division's manufacturing department. Mr. Craven will make his headquarters at the Stirling Ave. offices in Barberton, Ohio. He succeeds PAUL H. SETZLER, who has resigned. At the same time, the announcement was made that the board of directors has elected O. R. CARPENTER assistant vice-president, Boiler Division manufacturing department, reporting to Mr. Craven.

H. M. HARPER CO., Morton Grove, Ill., announces the opening of a new branch office at 109 Baker St., East Syracuse, N. Y.

GLEASON WORKS, Rochester, N. Y., has announced the election of LAWRENCE C. GLEASON to the office of president and general manager. HOWARD F. CARVER was elected to the position of vice-president and assistant general manager. The directors accepted the resignation of DWIGHT VANDEVATE, former vice-president and general manager.

B. & J. SPRING & EQUIPMENT CO., Mineola, L. I., announces that W. H. BRODIE has been elected president and chief executive officer. He replaces A. H. BRODIE, JR., who remains as chairman. An executive committee has also been established by the company which, in addition to the new president, includes EDWARD MARTIRE, in charge of the company's administration; E. J. RETTIG, head of operations; and E. H. PIANE, head of sales.

HOWARD ROBERTS has been appointed manager of engineering services for the TRUARC RETAINING RINGS DIVISION of Waldes Kohinoor, Inc., Long Island City, N. Y. Mr. Roberts will direct the firm's Truarc Technical Service, which provides engineering assistance to customers, field representatives, and distributors. He will conduct sales training and coordinate technical presentations.

North Carolina

AIR REDUCTION SALES CO., New York City, has started construction of a new $100,000 sales office and warehouse at 2300 South Boulevard, Charlotte, N. C. The facility is now located at 124 W. Third St., in that city. Occupancy will take place shortly after the first of January, 1960. In addition to the personnel of Air Reduction Sales Co., the new facilities will also house the sales and technical service staffs of Air Reduction Chemical Co., the Pure Carbonic Co., and the Ohio Chemical & Surgical Equipment Co. All of these companies are divisions of Air Reduction Co., Inc.

MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass., announces the appointment of MORRIS E. YANCEY, 701 Manhasset Road, Charlotte, N. C., to sales representative in North and South Carolina for the company.

Pennsylvania and Ohio

FIRTH STERLING, INC., Pittsburgh, Pa., started operations on November 2 of separate and complete tungsten-carbide sintering facilities at its McKeesport plant. Similar facilities have been established in Hartford, Detroit, Houston, and Los Angeles to meet emergency service requirements that cannot be met on a regular mill production basis. JAMES CAMPBELL, formerly manager of the Detroit sintering plant, will be in charge of the Pittsburgh plant.

FINISHED PRODUCTS DIVISION, Detroit Stamping Co., Detroit, Mich., announces that ERIE INDUSTRIAL SUPPLY CO., 1616 W. 8th St., Erie, Pa., has been appointed northwestern Pennsylvania stocking distributor for the full line of Detroit Stamping Co. toggle clamps manufactured by the company.

FIRTH STERLING, INC., Pittsburgh, Pa., announces the appointment of FENTON "TOMMY" TOMLINSON, JR., to its West Coast steel sales staff. Also, THOMAS R. QUAY has been appointed steel sales representative in the Minneapolis area.

W. SCOTT FITZ, JR., has been appointed market analyst for KENNAMETAL INC., Latrobe, Pa.

NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION, Cleveland, Ohio, elected new officers during its Fourteenth Annual Convention just concluded in New York who will serve during 1959-60. They are: Harold G. Murdock, first vice-president (vice-president of Arrowsmith Tool & Die Corporation, Los Angeles; E. W. Barnwell, treasurer (president of Apex Corporation, Roseville, Mich.); John A. Barth, president (vice-president and general manager, the Barth Corporation, Cleveland); John D. Dewhurst, secretary (president, Arrow Tool Co., Weth-

(Left) Lawrence C. Gleason, newly elected president and general manager, and (right) Howard F. Carver, vice-president and assistant general manager, Gleason Works.

ersfield, Conn.); and James A. Perdy, second vice-president (vice-president of Atlantic Mfg. Co., Philadelphia).

OHIO KNIFE Co., Cincinnati, Ohio, announced that it has purchased the manufacturing rights to the John M. Rogers patented, inserted-blade type reamers and mills from the OAK ENGINEERING Co., Gloucester, N. J. These rights include the patents for inserted-blade type hand reamers, chucking reamers, shell reamers, and hollow mills.

PARKER-HANNIFIN CORPORATION, Cleveland, Ohio, announces that ALTA ENGINEERING Co., 2950 S. Fox St., Englewood, Colo., and 770 S. 2nd West, Salt Lake City, Utah, has been made a newly franchised distributor for Parker industrial tube fittings and Crown regulators, filters, and lubricators.

A. H. GODFREY, nationally known production management consultant, has been named general manager of all divisions of PARK PRODUCTS Co., INC., Cleveland, Ohio.

Texas and Colorado

OILGEAR Co., Milwaukee, Wis., announces the opening of a Houston district sales, service and application-engineering office. The district, covering Texas, Oklahoma, Arkansas, Louisiana, Mississippi, western Alabama, and Tennessee, was formerly covered by the Rockford and Milwaukee offices. THOMAS M. HEALY, who formerly assisted in serving this area from the Milwaukee office, will be in charge. The new office is located at 4402 Richmond Ave., Houston 27, Tex.

THE TREADWELL TAP & DIE Co., Greenfield, Mass., announces the recent appointment of GEORGE E. METCALF and ROBERT J. WALSH as representatives for the complete line of Threadwell cutting tools in the Colorado area. Mr. Metcalf maintains his business as manufacturers' representative at 232 E. 20th Ave., Denver, Colo.

Wisconsin and Minnesota

H. STANLEY JOHNSON, executive vice-president of GISHOLT MACHINE Co., Madison, Wis., has retired from the firm. Mr. Johnson is also a member of the Gisholt board of directors and will continue to serve in this capacity. He recently completed thirty-five years of service.

GENERAL MILLS, INC., Minneapolis, Minn., has announced that it will acquire the business of Magnaflux Corporation, Chicago, Ill., which will operate as a subsidiary without change of name.

Canada

J. H. RYDER MACHINERY Co. LTD., Toronto, Canada, has been appointed Canadian representative for the NATIONAL AUTOMATIC MACHINE TOOL Co., INC., Richmond, Ind. Ryder will represent the entire NATCO line of standard multiple-spindle machine tools for drilling, boring, facing, and tapping, as well as special machines for automatic production. Ryder vice-president of Machine Tool Sales, U. C. CROOK, will be in charge of NATCO's Canadian sales. In addition to its head office at Queen Elizabeth Highway and Kipling Ave. in Toronto, the J. H. Ryder Machinery Co., Inc., has branch offices or representatives in Windsor, St. Thomas, and St. Catherines, Ont., Winnipeg, Vancouver, Montreal, Quebec, and Ottawa.

E. W. BLISS Co. of Canada, Ltd., of Toronto and John Bertram & Sons Co., Ltd., of Dundas, Ontario, now have an agreement for manufacture of the full line of Bliss metalworking machinery in Canada.

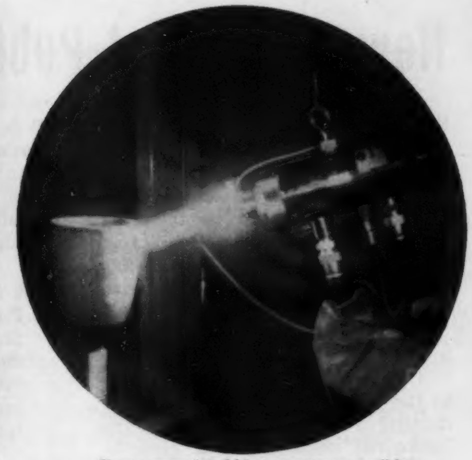
Obituary

J. CHESTER BATH, vice-president, treasurer, and a director of JOHN BATH & Co., INC., of Worcester, Mass., died on October 19 at the age of sixty-seven. He served for several years as sales manager in the company founded by his father in 1912. He was a director of the Metal Tool Cutting Institute and had been active in the American Standards Association and the American Society of Mechanical Engineers.

NTDMA Honors Richard F. Moore

For his contributions of time and talent to the contract tool and die industry, Richard F. Moore (right) president of the Moore Special Tool Co., Bridgeport, Conn., became the first recipient of the "L. A. Sommer Memorial Award" created by the National Tool & Die Manufacturers Association. This award pays honor to representatives of member companies who have rendered outstanding service to both the industry and the association. The award was presented at the Fourteenth Annual Convention of NTDMA in New York City by Philip R. Marsilius (left), a former president of the association and executive vice-president of the Producto Machine Co., Bridgeport, Conn. The award consists of a perpetual atmospheric-operated clock inscribed with a tribute.

NOW—
PLASMA FLAME SPRAY IN YOUR OWN PLANT



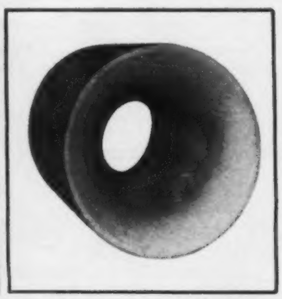
Flame spraying hi-temperature crucible

Apply coatings of high melting point materials with the METCO Plasma Flame Spray Gun...10,000°—15,000°F. A few: niobium carbide—tantalum carbide—thorium oxide—tungsten—zirconium boride

Now any material that can be melted without decomposing can be sprayed. Despite high melting temperature, object sprayed stays cool.

High fluidity of particles and high velocity of impingement bond particles together to produce high density coatings semi-fused to work surfaces. Absence of air eliminates oxidation.

Spraying tungsten on brass mandrel



Tungsten coated graphite part

Metco Type MB Plasma Flame Spray Gun

Here is a valuable new tool for the metalworking research department or production line. The METCO Plasma Flame Spray Gun operates on inexpensive inert gases, with high electrical power conversion efficiency and long component life. Continuous hot gas streams, as high as 30,000°F., with accurate control of temperature, can be generated for costs of ⅓ to ½ those of oxygen-fuel gas equipment for equivalent heat output.

Other advantages include push-button operation, extremely simple training of personnel, elimination of flash-back and explosion problems.

Materials that can be sprayed

Specifically, a wide range of metals and their oxides, carbides, borides, and refractories have been sprayed with the standard apparatus on various shaped objects and mandrels. Coating densities are easily controlled and up to 98% of theoretical can be obtained. Lowered oxide contents, with improved bond and tensile strengths are additional advantages.

Plasma Flame — how it works

The METCO Plasma Flame Spray Gun produces an arc contained in a water-cooled nozzle. An inert gas, blown through and around the arc, is "excited" to energy states having temperatures approaching 30,000°F. This Plasma "Flame" is used for melting and spraying any desired material.

The METCO Plasma Flame Gun is the latest development in flame-spraying equipment by METCO. Write today for free bulletins describing the various flame spraying processes and the Plasma Flame Spray Gun.

Metallizing Engineering Co., Inc.

METCO

Flame Spray Equipment and Supplies
Westbury, Long Island, N. Y. • Cable: METCO
Telephone: EDgewood 4-1300
In Great Britain: METALLIZING EQUIPMENT CO. LTD.
Chobham-Near-Woking, England

Metallizing Engineering Co., Inc.
1131 Prospect Ave., Westbury, L. I., New York

Please send me free bulletin on the Metco Plasma Flame Spray Gun.

Name ______ Title ______

Company ______

Address ______

City ______ Zone ______ State ______

For more data, circle this page number on inquiry card

New Books and Publications

PNEUMATICS FOR INDUSTRY. By F. X. Kay. (MACHINERY'S Standard Reference Series) 160 pages; 5 3/8 by 8 1/2 inches; illustrated. Published by the Machinery Publishing Co., Ltd., Brighton, England. Sold in the United States by The Industrial Press, 93 Worth St., New York 13, N. Y. Price, $3.

This book is intended as a guide to the principles underlying the industrial use of pneumatics. The term "industrial pneumatics" is used to distinguish the applications treated herein from those which can be termed "instrument pneumatics." To draw a distinction between these two types of application is perhaps not easy from fundamental considerations, except that instrument pneumatics is concerned with changes of air pressure due to very small displacements and, therefore, requires a high precision of detection. On the other hand, industrial pneumatics requires a range of equipment which, while being accurate, must also be rugged and able to work hard for long periods of time. In addition, such equipment must be versatile so that it can be used in many diverse branches of industry.

It is the object of this volume to describe some of the fundamentals governing the application of pneumatics, and to elucidate certain facts that are little known or somewhat difficult to understand.

BOLT, NUT, AND RIVET STANDARDS. Prepared by Committee on Standards and Technical Practices, Industrial Fasteners Institute. 288 pages; 5 1/2 by 8 3/4 inches; illustrated. Published by Industrial Fasteners Institute, 1517 Terminal Tower, Cleveland 13, Ohio. Price, $3.

This third edition is an enlarged and revised volume. It includes all of the current engineering standards, including those made since the 1952 edition. It is published as a guide for both manufacturers and users of industrial fasteners. Originated and published by Industrial Fasteners Institute, it brings together into one volume the nationally recognized dimensional standards for general-purpose industrial fasteners. These include bolts, nuts, studs, screws (machine-, cap-, tapping-, wood-), washers and rivets. Useful information includes Fastener Specifications and Standards, Grade Markings, Lock-nut Specifications, Terminology, Unified Screw Thread Standards, and other data.

ELECTRIC ENERGY CONVERSION. By Y. H. Ku. 522 pages; 6 by 9 inches; illustrated. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, $10.

This book provides a modern, unified treatment of all types of electrical machinery by approaching the subject from the standpoint of the underlying principles of electromechanical energy conversion. It is designed primarily as a college textbook for the basic machinery course required of electrical engineering students, although much of the material will be of interest to practicing engineers who have not had the benefit of a modern treatment of the subject.

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Annual Index to MACHINERY

The annual index to Volume 65 of MACHINERY (September 1958 to August 1959, inclusive) is now ready for distribution. Subscribers who have not previously requested copies can obtain them without charge by writing to MACHINERY, Circulation Department, 93 Worth St., New York 13, N. Y.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (TITLE 39, UNITED STATES CODE, SECTION 233) SHOWING THE OWNERSHIP AND MANAGEMENT

of MACHINERY, published monthly at Bristol, Conn, for October 1, 1959.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 93 Worth St., New York 13, N. Y.; Editor, Charles O. Herb; Managing Editor, Charles H. Wick; Business Managers, Robert B. Luchars, Edgar A. Becker, and Harold L. Gray. The address of all the foregoing is 93 Worth St., New York 13, N. Y.

2. The owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Walter E. Robinson, Charles O. Herb, Harold L. Gray, Clifford Strock, and Suno E. Larson, all of 93 Worth St., New York 13, N. Y.; Franklin D. Jones, 14 Washington Place East, New York 3, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, N. Y.; Edgar L. Becker, Nominee for Nancy Jane Becker, Susan Louise Becker, and Donald Louis Becker, 714 Wellington Road, Ridgewood, N. J.; Montclair National Bank & Trust Co. and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Montclair National Bank & Trust Co. and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; David D. Ketchum, 38 Mill Road, Falmouth, Mass.; Lee W. Noyes, Guardian for Susan Yarnall Urban, Greensboro, Vt.; Lee W. Noyes, Trustee under the Will of Robert L. Urban, Greensboro, Vt.; and John T. Urban, 8 Craigie Circle, Cambridge 38, Mass.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Dorothy B. Baldwin, 420 Clinton Ave., Brooklyn 38, N. Y.; Robert B. Luchars, 93 Worth St., New York 13, N. Y.; Franklin D. Jones, 14 Washington Place East, New York 3, N. Y.; Ann Pelletier, 116 Pinehurst Ave., New York 33, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 6825 Almansa St., Coral Gables, Fla.

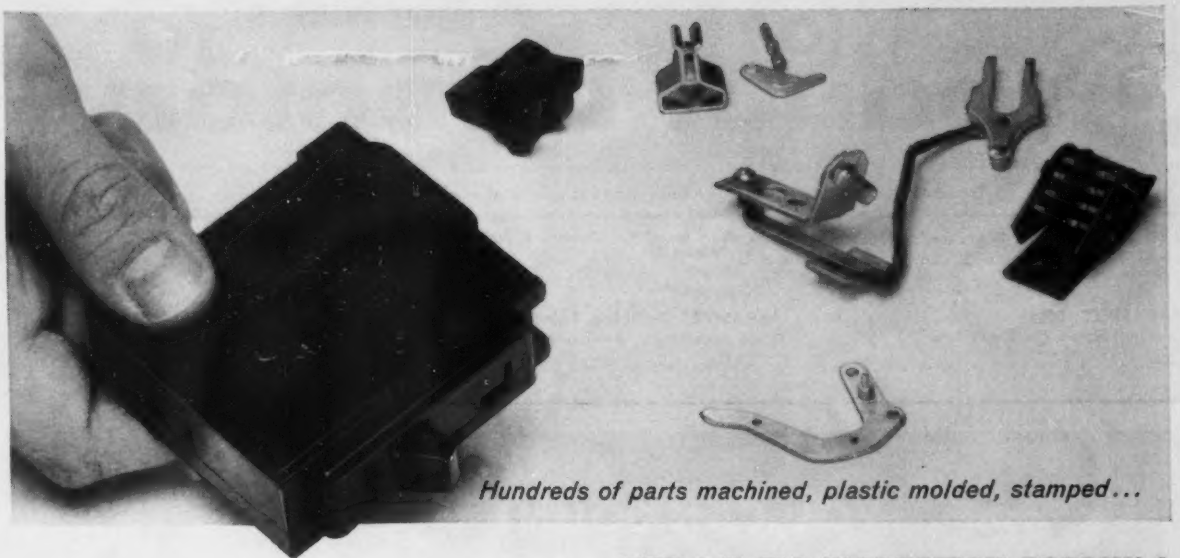
4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 15th day of September, 1959. (SEAL)

ALEXANDER LOYKA

Notary Public, State of New York
No. 31-7611350
Qualified in New York County
Commission Expires March 31, 1960



YET I-T-E'S INSPECTION FORMULA GUARANTEES PRECISION AS PRODUCTION RATES MULTIPLY!

Optical gaging inspects these tiny circuit breaker parts, in some cases seven times faster than hand methods. Permits more thorough, often more accurate, inspection of linear dimensions, hole diameters and locations, radii, angles and contours.

"We've found a practical method to retain precise quality in the many small parts we make to go into our circuit breakers," says the Small Air Circuit Breaker Division of I-T-E, in Philadelphia.

"That method makes *full* use of optical gaging with our Kodak Contour Projectors. They're in constant use to improve our quality and avoid production headaches at the same time.

"Starting in *receiving*, all components from our suppliers are optically checked to save later production snags. Tool and die samples and experimental parts in the *tool room* are optically checked. And finally, we inspect parts right in the *production* line. This way, inspection bottlenecks just don't happen."

Here are just a few reasons why I-T-E and other firms find inspection with a Kodak Contour Projector fast and accurate:

Parts and fixtures are easy to set up, even large parts.

You have a constant 8″ of working space regardless of magnification.

You can easily see and check what you're inspecting because there's brilliant, uniform illumination over the entire screen area, and the image is always erect and unreversed—at any magnification you select.

To learn more about these and other features of the Kodak Contour Projector and how they can ease your inspection problems, write for the booklet, "Kodak Contour Projectors."

Special Product Sales

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ABRASIVES, Disc
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Macklin Co.. Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Penna

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York, 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Jessop Steel Co., Washington, Penna.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Mueller Brass Co., Port Huron, Mich.

ALUMINUM and Aluminum Products
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
General Electric Co., Schenectady 5, N. Y.

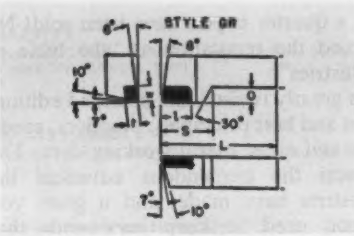
ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.


Just Published!
THE 16TH EDITION
NEW 16TH EDITION
MACHINERY'S HANDBOOK
REVISED and ENLARGED
THE BIBLE OF THE MECHANICAL INDUSTRY
INDUSTRIAL PRESS
ENLARGED!
192 pages added in the 16th Edition
REVISED!
over 500 completely new pages of reference information and data
READ COMPLETE DETAILS ON THE FOLLOWING PAGES

GIVES YOU THE LATEST DATA OTHER IMPORTANT SUBJECTS!

SINGLE-POINT CUTTING TOOLS. Added to this section are data on solid carbide inserts and their holders, with complete dimensions for each. These are the carbide cutting tools included in the latest American Standard.



SELF-TAPPING SCREWS. Data on drills and punched holes for self-tapping screws and the application of the various types of screws are presented.

TAPERS. Data on Morse stub taper shanks have been added to the already extensive taper-shank section of the Handbook.

SCREW THREAD INSERTS. Screw thread inserts including the self-tapping type are now widely used to achieve strong threads in soft materials, as well as for replacement of stripped threads.

TAPER PINS. To facilitate the machining of taper holes for taper pins a new chart has been provided showing drill sizes for step drilling prior to taper reaming.

GROOVED PINS. Dimensions of standard grooved pins have been given.

BOLTS, SCREWS, NUTS, WASHERS. Among the changes in this section are new American Standard dimensions for plain washers and toothed lock washers and clearances for box, open-end, and socket wrenches.

GRINDING, POLISHING, AND LAPPING. This new 54-page section provides the latest in available data, techniques, and process descriptions in connection with grinding wheels, wheel dressing, centerless-, surface-, cylindrical-, offhand- and portable-grinding. Tables of grinding troubles give recommendations for their correction. Descriptive data facilitate the selection of proper grinding wheels.

METAL JOINING, CUTTING AND SURFACING. This completely new 36-page section deals with soldering, brazing, hard facing, welding, flame cutting, arc-cutting, etc. In addition to detailed descriptions of each of these processes, convenient tables aid in the selection of the best process for the operation at hand. Explains brazing of high-speed steel tips to carbon steel shanks.

V-BELTS AND SHEAVES. The increasing use of V-belt drives is reflected in the new 17-page section dealing with such topics as: light-duty drives, belt cross-sections, sheave dimensions, horsepower ratings, multiple V-belts, V-belt installation, service factors, operating speeds, idlers, V-flat drives, double-angle V-belts, and selection procedure.

TRANSMISSION CHAINS. A section of 41 pages provides coverage of transmission roller chains and silent chains. Discussed are: sprockets, chain parts, keys, keyways, set-screws, center distance between sprockets, length of chain, cutting sprocket tooth form, sprocket materials, cutters for sprocket teeth, horsepower ratings, design procedure, chain designations and dimensions, drive ratios, chain selection, etc.

FLYWHEELS. Because the flywheel is so important as a source of energy for punching, shearing and other shop operations as well as a means of providing a uniform flow of energy in rotating engines, new data pertaining to the design of flywheels are given. This takes account of centrifugal stresses, combined stresses, and residual stresses. Of primary importance are the two up-to-date tables of safe speeds for flywheels in accordance with American Standard and insurance company requirements.

STRENGTH OF MATERIALS. The data given on the strength of materials, or mechanics of materials, take the guess-work out of determining the most economical size and shape of machine parts or structures to meet strength and deflection requirements. In addition to formulas and data that apply to straight beams and columns, new sections have been added, giving formulas and tables for curved beams such as are used in machine frames; pipe columns; round, rectangular, and square plates; cylinders subjected to internal and external pressure; tubes, and shells.

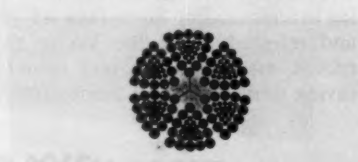
SHAFTS. Formulas and directly applicable tables for strength and horsepower capacity, as well as considerations of torsional and linear deflection for various conditions of loading, are given in detail. Included are formulas for critical speeds of rotating shafts, formulas for shafts of brittle materials, and data for the effect of keyways on shaft strength.

STANDARDS. Data and information from the latest American Standards have been included, wherever possible throughout the wide range of Handbook topics. Comparable data and information from a large number of British Standards have also been given to provide a reliable reference on British practice.

SPRINGS. The data for designing and winding springs have been supplemented by a new section giving a detailed description of the most widely used spring materials, their strengths, moduli of elasticity, service factors for various applications, endurance limits, and working stresses at elevated temperatures.

PLAIN BEARINGS. A complete section on the factors to be considered in the design and selection of plain bearings, as well as a step-by-step procedure utilizing simple charts and formulas, has been provided as a guide for the designer. In addition to complete tables of alloys for both solid and sintered bearings, information on wood bearings, plastic laminate bearings, rubber bearings and others is given and the procedure for babbitting bearings in the shop is explained in detail.

INVOLUTE FUNCTIONS. Involute functions of angles have been established as the most convenient means for solving certain problems in gear design and measurement. A complete set of involute functions from 14 to 58 degrees in increments of one minute and to as many as seven decimal places is provided.



WIRE ROPE. Some of the topics covered in this new 17-page section are: installation, safe working loads, factors of safety, sizes, simplified practice recommendations, drum and reel capacities, maintenance, lubrication, replacement.

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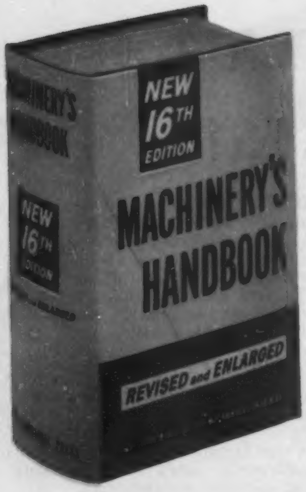

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METALWORKING Briefs

Inert-Gas Welding Fixes Damaged Cooling Turbines; Saves Navy $2150 Apiece

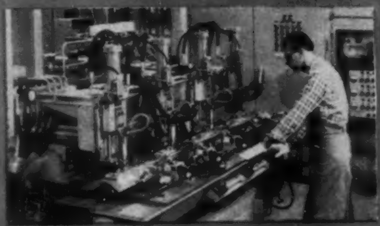
Basic economics: If a damaged cooling turbine costs $2300 to replace, you try to fix it first. When Norfolk Naval Station faced this problem, they found that only inert-gas tungsten-arc welding could make the delicate welds needed to secure the .004-in. special stainless alloy fins.

After damaged fins are cut from the hub, the section is machined to a U-shape and ground to a satin finish. New fins are welded in place with a HELIARC HW-10 torch. The HELIARC welds easily withstand the turbine vibration of 14,000 revolutions per minute and temperatures over 1750 deg. F. *Total cost of repair: $150.*

New Tape-Controlled HELIARC Machine Mass-Produces "Problem" Missile Parts

A tape-controlled, multi-torch machine, invented and developed by LINDE, makes more than 2500 HELIARC spot welds per hour on problem parts for "Terrier" surface-to-air missiles built by Convair. The machine covers a 20x80-in. area. Accuracy is better than .001 in. and welds meet shear-strength requirements of 2000 lbs. each.

Since many "Terrier" parts, such as control and dorsal fins, can be welded from only one side, resistance spot welding is impossible. HELIARC spot welds are ideal because they require access to only one side. The fins are made from 1020 carbon steel and 17-7 ph stainless, varying from .0016- to .0090-in. thick.



2500 spot welds an hour on "Terrier" problem parts.

A punched-tape controls the weld locations, torch combinations, time and current at each step. These LINDE machines are adaptable to semi- or fully-automatic production. They can be equipped with enough HELIARC torches to produce a theoretically unlimited number of spot welds simultaneously.

HELIARC spot welding utilizes a new LINDE-invented method of positive and instantaneous arc ignition—Pilot-Arc starting—which eliminates all high-frequency interference and avoids the contamination of retract starting.

Although particularly suited to the aircraft and automotive industries, HELIARC spot welding is a precision process, adaptable to any industry which demands complete mechanization, high speed, and top quality on a mass-production scale.

MECHANIZED WELDING QUADRUPLES ALUMINUM AIRCRAFT PARTS OUTPUT

A quick switch, from manual to mechanized welding, has more than quadrupled production of oil-temperature regulators and fuel-to-oil heat exchangers at Airesearch Manufacturing, Los Angeles.

SWM-2 SIGMA welding machines join the 6061 aluminum parts at speeds up to 85 inches per minute. Replacing manual covered-electrode welding, LINDE's inert gas process reduced production time on the heat exchangers from one hour to 13 minutes, and on the regulators from 40 minutes to ten minutes. As a result, daily production of these two units has increased from 8 to 35 and 12 to 48, respectively.

Short Work With "Short-Arc"

To increase production of tank-ejector units while reducing costs, Fletcher Aviation, Rosemead, Calif., replaced covered-electrode welding with LINDE's new "Short-Arc" welding process. It uses a 16-oz. torch with a low-voltage, short-arc for easy control of steels .030 to 1/8-in. thick.

The high welding speed, semi-automatic operation, and slag elimination (photo) increased Fletcher's production from 50 to 300 units a day. Unit cost shrank from $1.14 with covered-electrode welding (labor and overhead, $1.12; consumables, 2¢) to only 29¢ (labor, 19¢; consumables, 10¢)—a saving of 75 per cent.

America's Missiles and Satellites Soar On HELIARC and SIGMA Welded Joints

Inert-gas shielded-arc welding plays an important role in fabricating American satellites and missiles. The Army's "Explorer," made from .025-in. stainless at Cal Tech's Jet Propulsion Lab, Pasadena, and the Navy's "Vanguard," made from .090-in. magnesium alloy at Brooks & Perkins, Detroit, are both welded with LINDE's HELIARC HW-9, HW-17 and HW-18 torches.

Rocketdyne Division of North American Aviation, Canoga Park, Calif., uses HELIARC welding on the Redstone engine's heat exchanger, thrust chamber, and peroxide tank. The process makes top-quality welds on all the parts, despite the varying thicknesses of aluminum and 17-7 ph stainless.

Reynolds Metals' missile plant in Sheffield, Ala., uses mechanized SWM-3 SIGMA welding to make more than 1000 ft. of welds on the 5086 aluminum outer jacket and center section of the "Redstone" and "Jupiter-C" missiles. The longitudinal and circumferential welds reach speeds up to 100 inches per minute.

During all fabrication, the HELIARC and SIGMA welds are protected from atmospheric contamination by 99.995% pure LINDE argon.

Precision welding pays off—neither the satellites nor the missiles have ever failed due to faulty welds.

FOR DETAILS . . . on any of LINDE's modern welding methods and for regular copies of LINDE's 24-page, bi-monthly METALWORKING BULLETIN, write Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited. "Linde," "Heliarc," "Sigma," "Unionarc," "Unionmelt," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

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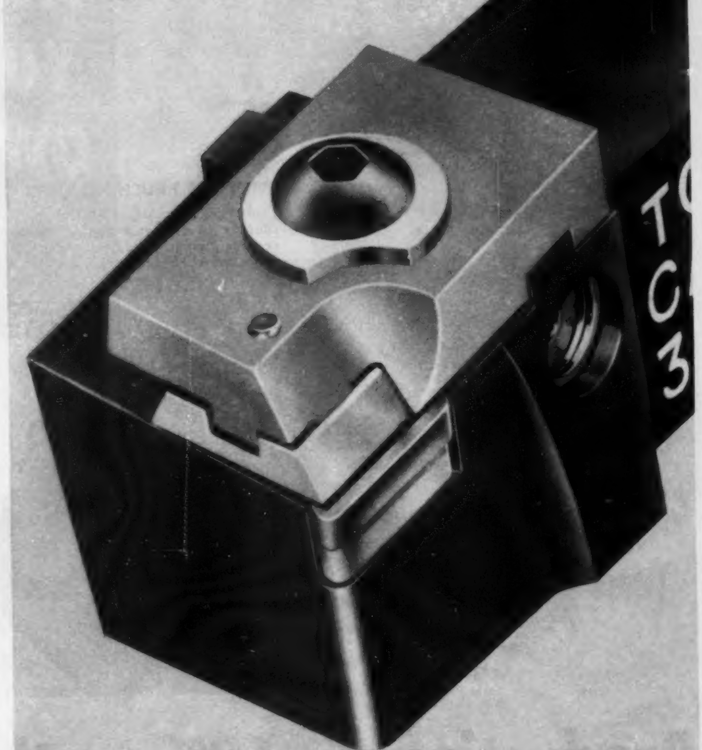
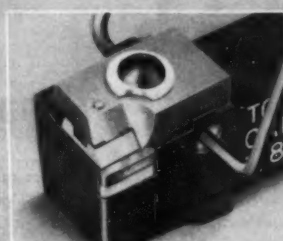
Metallurgical Memo from General Electric



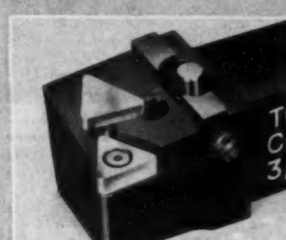
*Sizes 16V and 85V: adjustable range 1/16" to 7/32"
Size 20V: adjustable range 1/16" to 11/32"



1. Chipbreaker setting adjusts to any width within range.* Set screw with two open ends provides access from either side. No springs to adjust.

2. Design permits absolute repeatability of settings. Floating chipbreaker is indexable. Can't drop out when clamp is loosened.

3. Clamp screw is accessible from top or bottom; allows easy indexing or replacement even when toolholder is vertical or upside down.



4. Standard disposable inserts, Carboloy insert seats and convertible seat are used with toolholder. Insert seats are indexable and self-aligning.

For more data, circle this page number on inquiry card

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Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINES, Surface

Cincinnati Milling Machine Co., Special Machine Div., Marburg Ave., Cincinnati 9, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

BULLDOZERS, Metalforming

Birdsboro, Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

BURNISHING MACHINES

Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
Universal Engrg. Co., Frankenmuth, Mich.

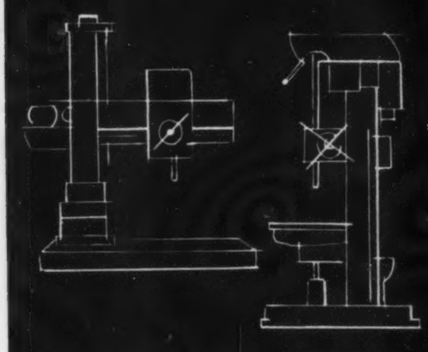
BUSHINGS, Hardened Steel

Universal Engrg. Co., Frankenmuth, Mich.

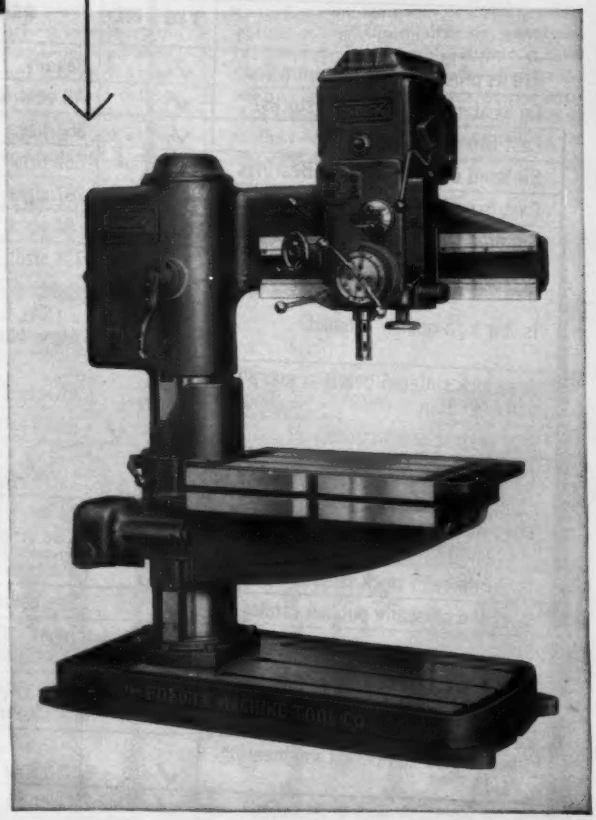
BUSHINGS, Non-ferrous and Powdered Metal

Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Universal Engrg. Co., Frankenmuth, Mich.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools Machinists' Small Tools



WHY BUY TWO WHEN one WILL DO?



Fosdick's Sensitive Radial combines Upright and Sensitive features—rigidity, compactness and convenient table height—with the capacity and flexibility of a Radial. Fosdick has made the table unusually adjustable, leaving the arm at a fixed height. The unique, one-piece column construction makes possible unusual rigidity. Arm clamping is simplified. You get *all* the advantages of *both* the old reliable drills, at roughly the cost of one!

Workpiece sizes accommodated by the Sensitive Radial include the ranges of both Uprights and Radials; setting up on either the adjustable table or the base of the machine. Controls remain clustered at a constant, convenient operator's height.

YOUR TOOL DOLLAR buys more capacity in less shop space when you put Fosdick's compact versatility to work on your drilling problems. Only Fosdick builds the Sensitive Radial. Call your distributor or write for Bulletin SRM.

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SENSITIVE AND UPRIGHT DRILLS
JIG BORERS & GRINDERS
NUMERICAL CONTROLLED PRECISION BORING MACHINES
SENSITIVE RADIAL DRILLS

FOSDICK

CALIPERS, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

CAMERAS, High Speed
Wollensak Optical Co., Rochester 21, N. Y.

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Shenango Furnace Co., Dover, Ohio
Textile Machine Works, Reading, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65 St., Cleveland 2, Ohio
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Malleable Castings Council, 781 Union Commerce Bldg., Cleveland 14, Ohio
Shenango Furnace Co., Dover, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Textile Machine Works, Reading, Penna.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Jessop Steel Co., Washington, Penna.

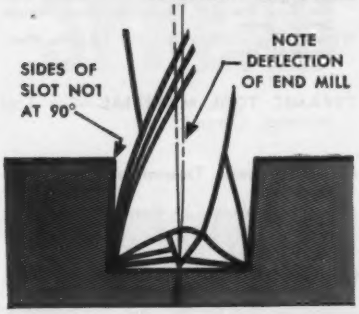
CENTER-DRILLING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
DoAll Co., Des Plaines, Ill.

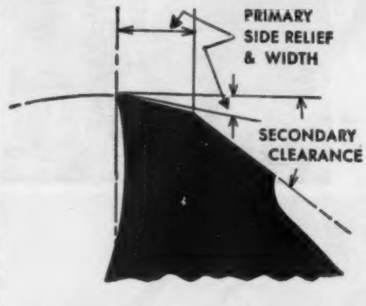
(Continued on page 262)

END MILL TIPS YOU CAN USE



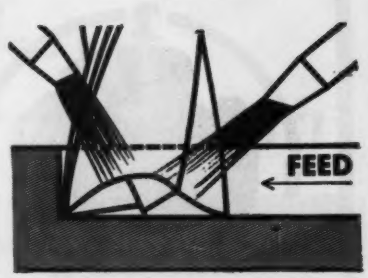
"WOBBLE"... ITS CAUSE AND CURE

Non-perpendicular sides of a slot can be caused by a worn spindle, excessive flute length, or too slow spindle speed. This "wobble" slot is actually a deflection of the end mill caused by one flute hogging into the cut. If the proper end mill with shortest necessary flute length is being used, eliminate spindle runout and increase its speed.



END MILL RESHARPENING

Always consider the material to be cut, and grind to limits recommended by the tool manufacturer. It is best to resharpen end mills to produce just enough primary relief to eliminate drag. Too much relief causes chatter . . . brings on rapid dulling of cutting edges. Secondary relief depends on the size of the end mill, the width of the primary relief, and the feeds being used.



ABOUT CUTTING FLUIDS

End mills require cutting fluids to protect the tool, control temperatures, and provide lubrication. Multiple streams generally provide more cooling effect than a slow moving heavy flow. Remember that present day jet cooling methods do not provide sufficient cooling because of greater tooth-to-work contact in end milling as opposed to turning operations.

FOR QUICK SOLUTIONS TO **ALL** YOUR DRILLING-REAMING-END MILLING PROBLEMS, SEE CHICAGO-LATROBE CATALOG No. 58, OR CONSULT A C-L SERVICE ENGINEER

BEST TIP OF ALL . . .

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END MILLS • COUNTERSINKS
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Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P.O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio

CHUCKS, Air Operated

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Combination Universal-Independent

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

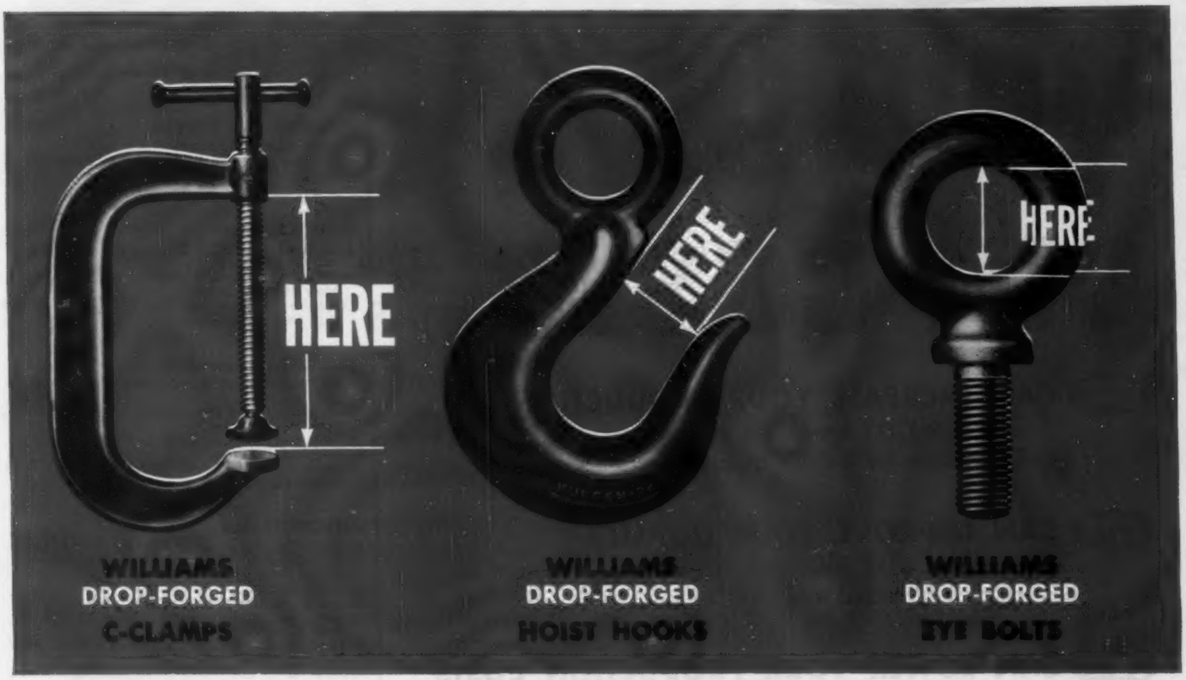
CHUCKS, Compensating

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.

(Continued on page 264)

SPREAD RESISTANCE...

WHERE YOU NEED IT!



Five styles in a broad range of sizes and capacities up to 18". Drop-forged from selected steel and heat-treated to further increase strength and reduce liability of springing. Screws are made of special grade steel hardened and tempered.

NEW Alloy Hoist Hooks add 27 additional capacities to Williams extensive line of carbon and alloy steel hooks. Eye and shank styles in regular and safety patterns. Safe working load capacities up to 70 tons. Write for new brochure A-575.

Vulcan Eye Bolts are proof-tested to military standards to 50% beyond "safe working load". Plain and shoulder patterns. Blank or threaded. Capacities from 400 lbs. to 16 tons.

all are stronger and safer because...

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Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill, Key Type
Jacobs Mfg. Co., West Harford, Conn.

CHUCKS, Drill, Keyless
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N.Y.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Full Floating
Gisholt Mch. Co., Madison 10, Wis.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.

CHUCKS, Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathe
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Jacobs Mfg. Co., West Hartford 10, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.

(Continued on page 266)

World's Most Extensive Line of Permanent Magnetic Chucks*

O. S. Walker, the originator of magnetic chucks, offers you unequalled quality and unequalled performance in every permanent chuck application. And the Walker line of fine chucks covers a *full range* of sizes.

Walker chuck magnets are the most permanent magnets ever made: they're ceramic, with many times the coercive force of alloy magnets. Other features include: *all steel* face; 50% less weight; low, low height; fine pole divisions; easy on-off lever. Write for our catalog.

Stock Sizes: 4 x 4"; 4 x 8"; 6 x 6"; 6 x 10"; 6 x 12"; 6 x 18"; 8 x 24"; 10 x 15"; 10 x 24"; 12 x 12"; 12 x 18"; 12 x 24".

*Patents Pending

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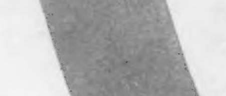
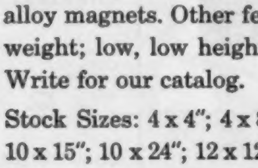
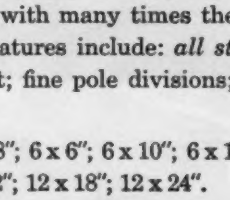


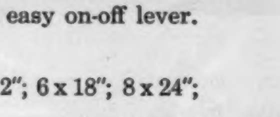
Special vacuum chucks for holding non-ferrous parts



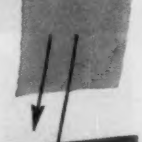
Bar pole electro-magnetic chucks in 81 sizes



Electro-magnetic chucks in 172 sizes



Special electro and magnetic chucks and magnetic holding fixtures



Standard and special demagnetizers

Logansport Mch. Co., Ins., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Wrenchless
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Oakite Products, Inc., 26 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works Co. 3817 St. Clair Ave., Cleveland 14, Ohio.
Minster Mch. Co., Minster, Ohio.

COLD HEADING
National Machinery Co., Tiffin, Ohio.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 883, Dayton 1, Ohio.

COMPARATORS, Optical
DoALL Co., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cuttings, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Wilson, K. R. Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Textile Machine Works, Reading, Penna.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

CONTROL SHAFTS—See Lead-screws & Splines, Ball Bearing

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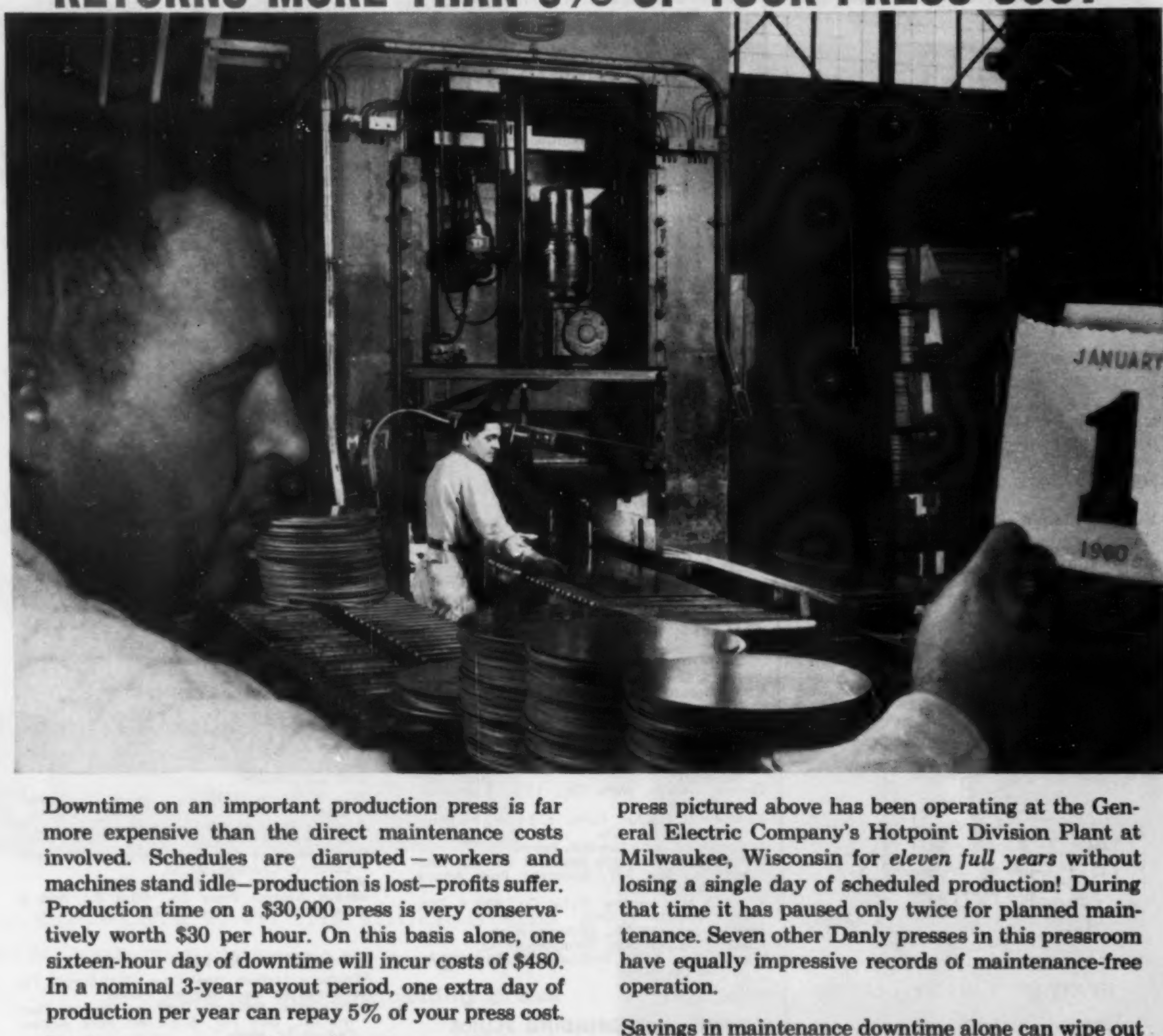
EVEN ONE LESS DAY OF DOWNTIME PER YEAR RETURNS MORE THAN 5% OF YOUR PRESS COST



Downtime on an important production press is far more expensive than the direct maintenance costs involved. Schedules are disrupted – workers and machines stand idle–production is lost–profits suffer. Production time on a $30,000 press is very conservatively worth $30 per hour. On this basis alone, one sixteen-hour day of downtime will incur costs of $480. In a nominal 3-year payout period, one extra day of production per year can repay 5% of your press cost.

Danly presses are engineered to give you that extra day of production, *many times over*. Design innovations years ahead of the industry, and an extra measure of brawn and precision keep Danly equipment on the job month after month, without maintenance interruptions.

Outstanding case in point: the 500-ton, straight side press pictured above has been operating at the General Electric Company's Hotpoint Division Plant at Milwaukee, Wisconsin for *eleven full years* without losing a single day of scheduled production! During that time it has paused only twice for planned maintenance. Seven other Danly presses in this pressroom have equally impressive records of maintenance-free operation.

Savings in maintenance downtime alone can wipe out all price differential between quality and "economy" equipment. Still more profit will be realized from longer die life, improved parts accuracy, and other bonus benefits. For a frank and comprehensive review of these advantages, SEND FOR BULLETIN 300.

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COOLANTS—See Cutting & Grinding Fluids

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American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Mohawk Tools, Inc., Montpelier, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1200 Woodward Heights Blvd., Detroit 20, Mich.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14, Hayward St., Quincy 71, Mass.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTERS, Keyseating
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoALL Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.

CUTTERS, Milling
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills).
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Meryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

CUTTING AND GRINDING FLUIDS
Cincinnati Milling Machine Company, Cincinnati Milling Products Div., Marburg Ave., Cincinnati 9, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Johnson, S. C. & Son, Inc., Racine, Wis.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.
Texaco, Inc., 135 E. 42nd St. New York 17, N. Y.

CUTTING-OFF MACHINES, Lathe Type
Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Johnson Manufacturing Co., Albion, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

CYLINDERS, Hydraulic
Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Tomkins-Johnson Co., Jackson, Michigan
Vickers Inc., Administrative & Engineering Center, Box 302, Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES
Barber-Coleman Co., 1300 Rock St., Rockford, Illinois
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

DEMAGNITIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES
B & T Machinery Co., Rockford, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Minster Machine Co., Minster, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

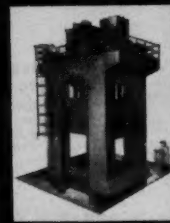
DIE SETS AND DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Lempco Industrial, Inc., Bedford, Ohio.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit, Inc., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

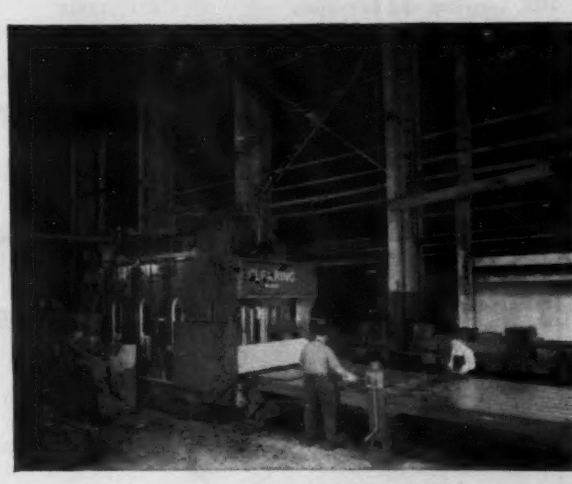
DIE STOCKS—See Stocks and Dies

When it comes to Hydraulic Presses...

large or small

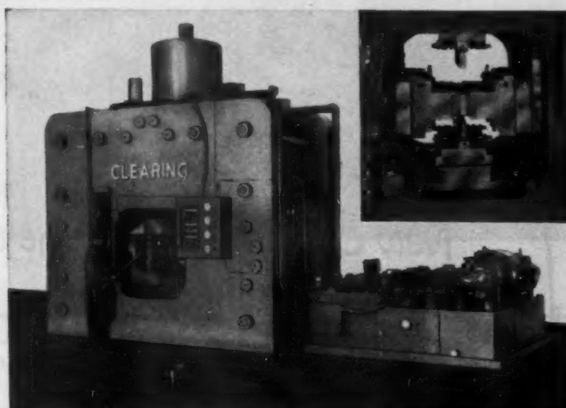


FOR ANY TYPE OF APPLICATION such as these metalworking drawing presses



WITH SPECIAL FEEDING EQUIPMENT as shown on this metal bonding machine

WITH ANY TYPE OF CONTROLS as seen on this rubber pad forming press



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There are no limitations on the type and size of hydraulic press equipment Clearing can design and build for you. No limitations either on the creative engineering you'll find at Clearing. Working with "new" metals—titanium, tantalum, columbium, uranium, zirconium?

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DIES, Blanking, Forming, Drawing, Extruding, etc.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit, Inc., Akron, N. Y.

DIES, Lettering and Embossing
Wales-Strippit, Inc., Akron, N. Y.

DIES, Self-opening Threading
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.

DIE STEELS
Jessop Steel Co., Washington, Penna.

DISINTEGRATORS
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Michigan, Troy, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS
Allen Mfg. Co., Bloomfield, Conn.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

DRAWING COMPOUNDS
Oakite Products Inc., 26 Rector St., New York 6, N. Y.
Stuart, D. A. Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DRIFT KEYS
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoALL Co., Des Plaines, Ill.

DRILL HEADS, Multiple Spindle
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield 1, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Middletown, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Thriftmaster Products Corp., 1014 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp, Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.

DRILL SLEEVES AND EXTENSION HOLDERS
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

(*Continued on page 272*)

Machining gib for heavy duty lathe from cold rolled steel. Depth of cut: $^3/_4$"; feed: .060"

DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Inc., S. 7th & N Sts., Richmond, Ind.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co. Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Kaukauna Machine & Foundry Div., Biddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINE FEEDS, Hydraulic

Beckett-Harcum Co., Wilmington, Ohio

DRILLING MACHINES, Automatic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 12th St., Milwaukee 10, Wis.
Edlund Mchry. Co., Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Lond Island City 1, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.

DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Berthiez, Charles, 5 Rue Montalivet, Paris, France.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Wales-Strippit, Inc., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl & Eggleston Ave., Cincinnati, Ohio.
Burg Tool and Mfg. Co., Inc., 15001 Figueroa, Gardena, Calif.
Carlton Mch. & Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.

DRILLING MACHINES, Sensitive

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figuera, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwod, Illinois.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Wales-Strippit, Inc., Akron, N. Y.

DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.

DRILLS, Center

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Mohawk Tools, Inc., Montpelier, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier. *ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Building, Pittsburgh 22, Pa. Address Dept. M-24.*

WSW-7259

ALLEGHENY LUDLUM

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DRILLS, Deep Hole, Gun
Ace Drill Corp., Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Eldorado Tool & Mfg. Corp., Milford, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Oil Hole, Oil Tube
Chicago-Latrobe, 411 Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.

DRILLS, Portable pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

DRILLS, Subland
Ace Drill Corp., Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield. Mass.
Mohawk Tools, Inc., Montpelier, Ohio.

DRILLS, Twist, High-Speed Steel, Carbon Steel
Ace Drill Corp., Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mohawk Tools, Inc., Montpelier, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped
Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio
Cogsdill Twist Drill Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

ELECTRICAL DISCHARGE MACHINES —See Disintegrators

ELECTRONIC CONTROL SYSTEMS
Hughes Products, Internationl Airport Station, Los Angeles 45, Cal.
Micro-Path Inc., Ingelwood 2, Calif.
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Stromberg-Carlson Div., General Dynamics Corp., 1493 N. Goodman St., Rochester 3, N. Y.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

For more data, circle this page number on inquiry card

FEEDERS, Automatic
Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
Gear-O-Mation Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.

FILES AND BURRS, Rotary
DoALL Co., Des Plaines, Ill.
Jarvis Corp., Middletown, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engineering Corp., Meriden, Conn.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.
U. S. Hoffman Machinery Corp., Syracuse, N.Y.

FLAME-HARDENING MACHINES
Cincinnati Milling Machine Co., Meta-Dynamics Div., Marburg Ave., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FLEXIBLE SHAFT EQUIPMENT
Jarvis Corp., Middletown, Conn.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.
Wyman-Gordon Co., Worcester, Mass.

FORGINGS, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
Vanadium-Alloys Steel Co., Latrobe, Penna.
Wyman-Gordon Co., Worcester, Mass.

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Vanadium-Alloys Steel Co., Latrobe, Penna.

FORMING MACHINES, Cold-Rolling
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., Mount Gilead, Ohio Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C. Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., P. O. Box 3806, Detroit, Mich.
Comtor Co., 47 Farwell St., Watham 54, Mass.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

GAGES, Multiple Inspection

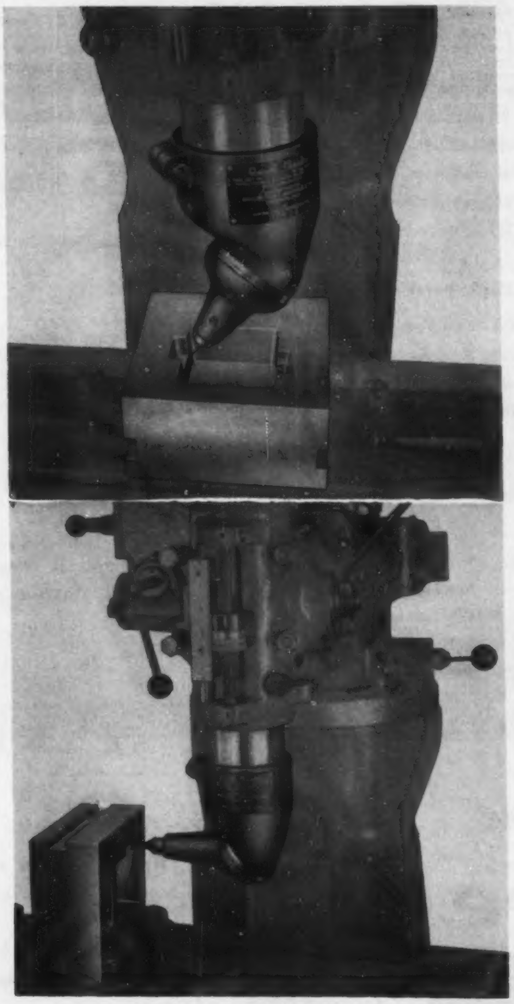
Federal Products Corp., 1144 Eddy St., Providence 1, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring

Brown & Sharpe Mfg. Co., Providence, R. I.
Deltronic, Costa Mesa, Calif.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

(Continued on page 282)

QUILL MASTER



ANOTHER FIRST
by
Bridgeport

Practically eliminates setup time

As illustrated at the left, the spindle housing of the attachment may be adjusted to any position between vertical and horizontal. For example, in the picture at the top, the spindle housing is tilted enough to clear the inside walls of an impression. With the J-Head or the Masterhead set to any compound angle and with a DOWN motion of the quill manually (or by feed on the J-Head) any compound angled corner with any small radius is easily milled finished. No resetting of the workpiece is required to attain this result. Consequently, the Quill Master saves, and in many cases practically eliminates setup time.

Speed increase by 50% (on the Type JA only) allows efficient use of small end mills.

This attachment is made in two sizes: Type JA fits the quill of the J-Head and Type MA fits the quill of the Masterhead and the Cherrying attachments.

As illustrated here, again with the spindle housing slightly tilted, deep cherrying to practically sharp corners is easily done with regular standard, short ball cutters. This, of course is a tremendous advantage in this type of work and will no doubt be recognized first by the tool and diemaker.

For more complete details contact your dealer or us direct.

Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll, Thread, Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness

DoALL Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Heigh, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

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Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING ROUNDING AND DEBURRING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, Geoge Co., Inc., 200 Lafayette S., New York 12, N. Y.

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

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Barber-Colman Co., 1300 Rock S., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springeld, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. Nichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS

Illinois Gear & Mch. Co., 2108 N. Natchez Ave., Chicago 5, Ill.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS

Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Non-metallic

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 N. Natchez Ave., Chicago 5, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

GEARS, Cut

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
Illinois Gear & Mach. Co., 2108 N. Natchez Ave., Chicago 5, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(*Continued on page 284*)

New Jersey Gear Mfg. Co., 1470 Chestunt Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

GENERATORS, Electric

Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES

Gorton Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag

Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummurt-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Carbide Tool

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Elox Corp. of Michigan, Troy, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold

DoALL Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Oliver Instrument Co., 1410 E. Maumee, Adrian Mich. (also drill point thinner)
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.

GRINDERS, Face Mill

Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St. Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., Niles, Ill.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Michigan, Troy, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro Pa.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co, 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost

Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

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Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Broach

Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
National Broach & Mch. Co., 5600 St. Jean Detroit 13, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Cincinnati Milling Machine Co., Grinding Mch. Div., Marburg Ave., Cincinnati 9, Ohio
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Van Norman Machine Co., 3640 Main St. Springfield 7, Mass.

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Cincinnati Milling Machine Co., Grinding Mch. Div., Marburg Ave., Cincinnati [illegible], Ohio
Cosa Corp., 405 Lexington Ave New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Hammond Machinery Builders Inc., Kalamazoo, Mich.
Landis Tool Co. Inc., Waynesboro, Pa.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd. Cincinnati 4, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Brown & Sharpe Mfg., Co., Providence, R. I.
Gardner Machine Co., Beloit, Wis.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Gear Grinding Machine Co., 3901 Christopher St., Detroit 11 Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight S. W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co. Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Grinding Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Elox Corp. of Michigan, Troy, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 4, Wis.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Berthiez, Charles, 5 Rue Montalivet, Paris, France
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2 N. Y.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S. Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Brown & Sharpe Mfg., Co., Providence, R. I.
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Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co. Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Olivetti Corp of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.

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Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling Machine Company, Cincinnati Milling Products Div., Marburg Ave., Cincinnati 9, Ohio
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N. Y.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa
Edlund Mchry. Co. Div., Cortland, N. Y.

(*Continued on page 290*)

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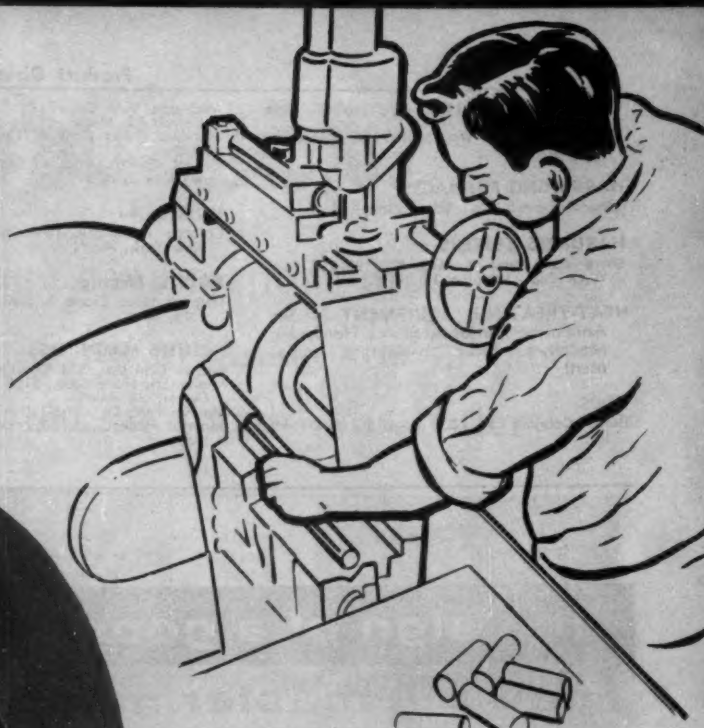
by MACKLIN



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General Electric Co., Schenectady, N. Y.

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.

HEAT-TREATING EQUIPMENT — See Annealing Furnaces, Flame Hardening Machines, Induction-Heating Equipment

HOBS

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co. Rochester, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

HOISTS, Electric

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONING MACHINES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-120th St., Moline, Ill.
Superior Hone Corp., 1623 Elreno St., Elkhart, Ind.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

HONING STONES

Barnes Drill Co., 814 Chestnut Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

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American Metal Hose Br. American Brass Co., 35 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

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Tools and equipment

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Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss E. W., Co., 1375 Raff Rd., E. W. Canton, Ohio
Burg Tool and Mfg Co., Inc., 15001 S. Figueora, Gardena, Calif.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Northern Hydraulics & Mch. Corp., Melrose Park, Ill.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St. Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford. Ill,
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
du Mont Corp., Greenfield, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.

QUICK COMPARISON CHART

Some unique combinations of electrical and physical properties in Anaconda metals that may save you money—handle tough jobs better

Properties shown for precipitation-hardened condition—Heat-treatable alloys	ELECTRICAL CONDUCTIVITY % IACS	TENSILE STRENGTH psi	YIELD STRENGTH at 50% ext. under load, psi	ELONGATION % in 2 in. or 4xD	MACHINABILITY compared with F.C. Brass at 100	FORMS AVAILABLE
Chromium Copper-999 (Cu 99.05%, Cr .85%, Si .10%)	75	65,000	55,000	20	20	Rod, Wire, Tube, Forgings, Strip
Leaded Nickel Copper-831 (Cu 97.8%, Pb 1.0%, Ni 1.0%, P .2%)	55	80,000	70,000	7	80	Rod
Cunisil-837 (Cu 97.5%, Ni 1.9% Si .6%)	30 to 42	90,000	70,000	8	40	Rod

To give you a basis of comparison, here are properties of two standard Anaconda electrical coppers

ETP Copper—100 (Cu 99.9+%)	100	48,000	40,000	15	20	All mill forms
Leaded Copper—126 (Cu 99.0%, Pb 1.0%)	98	48,000	40,000	12	80	Rod bar

The values given above are intended as a guide to some unusual combinations of electrical and physical properties available among Anaconda alloys. If any of them gives you an idea for possible solution to a tough problem or indicates a way to cut costs without sacrificing quality or performance — see your American Brass representative for more details. Or send in this coupon today.

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☐ Chromium Copper—999 ☐ Leaded Nickel Copper—831
☐ Cunisil—837 ☐ Leaded Coppers
☐ Electrolytic Tough Pitch Copper—100

Name....................................
Company....................................
Street....................................
City.................... Zone..... State............

INDICATORS, Dial
Ames B. C., Waltham 54, Mass.
Brown & Sharpe Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th-N. Sts., Richmond, Ind.

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
General Electric Co., Schenectady, N. Y.

INDICATORS, Test
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence, R. I.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INDUCTION HEATING EQUIPMENT
Cincinnati Milling Machine Co., Meta-Dynamics Div., Marburg Ave., Cincinnati 9, Ohio
General Electric Co., Schenectady, N. Y.
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Orban, Kurt Co., Inc., 42 Echange Place, Jersey City 2, N. Y.

INTENSIFIERS, Hydraulic
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.

JACKS, Planer—See Set-Up Equipment

JIG BORERS
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.
Orban Kurt., Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafavette St., New York 12, N. Y.

JIGS AND FIXTURES
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS
Baker Bros Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Williams J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES
Cincinnati Milling Machine Co., Grinding Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6. Mas.

LATHE ATTACHMENTS
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4235 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio
Williams J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

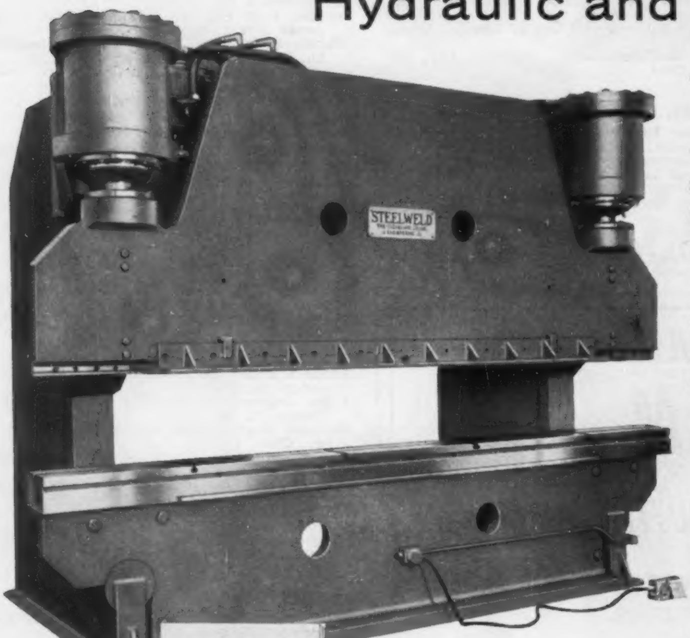
LATHES, Axle
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp. Hamilton, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt., Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 Colege Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co, Madison and Edwards Rds. Cincinnati 18, Ohio
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Car Wheel
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio

STEELWELD PRESS BRAKES

Hydraulic and Mechanical



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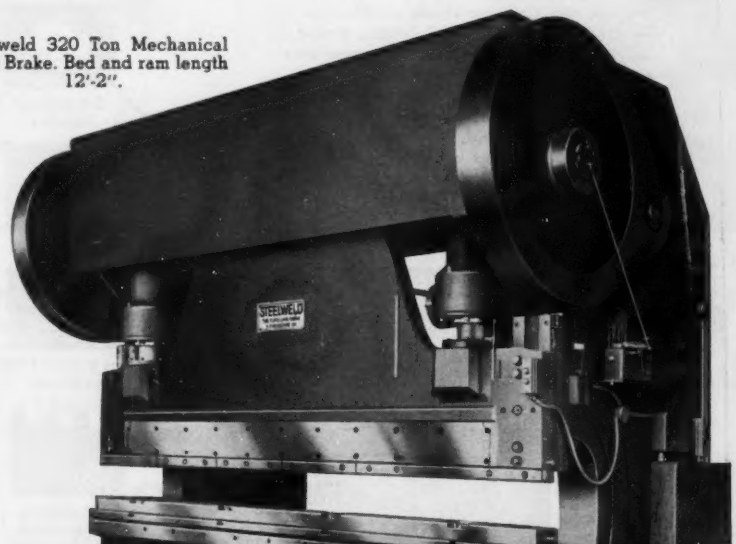

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LATHES, Center Drive

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LATHES, Crankshaft

Consolidated Mch Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds, Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating

Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney Ohio
Sidney Machine Tool Co., Highland Ave., Sidney, Ohio

LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Carroll-Jamieson Mch. Tool Co., Batavia, Ohio
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10 N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Carroll-Jamieson Mach. Tool Co., Batavia, Ohio
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Hardinge Bros. Inc., 1420 Collge Ave., Elmira, N. Y.
Hendey Mch Div., Barber Colman Co., Rockford Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

LATHES, Gap

Cincinnati Lathe & Tool Co., 3207 Disney St. Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 649 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sidney Machine Tool Co., Highland Ave., Sidney, Ohio

LATHES Hollow Spindle

Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Bliss E. W., Co., Canton, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Speed, Second-operation

Clausing Div, Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sideny, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling Machine Co., Meta-Dynamics Div., Marburg Ave., Cincinnati 9, Ohio (Hydrospin)
Cosa Corp., 405 Lexington Ave., New York 17. N. Y
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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LATHES, Toolroom—See Lathes, Engine, Toolroom

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Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfeld, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES Turret, Ram Type, Saddle Type
Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret, Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
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Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A. Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.
Texaco, Inc., 135 E. 42nd St. New York 17, N. Y.

LUBRICATING SYSTEMS
Madison-Kipp Corp., Madison, Wis.
Trabon Engineering Corp., Solon, Ohio

MACHINERY, Used and Rebuilt
Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Van Keuren Co., Watertown 72, Mass.

MACHINISTS' SMALL TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Pannier Corp., 319 Pannier Bldg., Pittsburgh 12, Pa.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MICROMETER HEADS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Slocomb, J. T. Co., Glastonbury, Conn.
Van Keuren Co., 176 Waltham St., Watertown 12, Mass.

MICROSCOPES, Toolmakers'
DoALL Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.

(Continued on page 298)

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- Maximum diameter in gap faced in one setting of tool.

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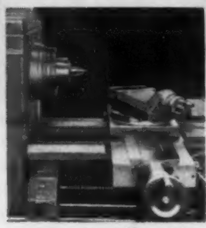

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Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Onsrud Machine Works, Inc., Niles, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island 1, N. Y.
Onsrud Machine Works, Inc., Niles, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Bench, Hand

Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Michigan, Troy, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sundstrand Mch. Tal Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio

Clearing Div., of U.S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Onsrud Machine Works, Inc., Niles, Ill.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

MILLING MACHINES, Knee Type Turret

Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 11110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

MILLING MACHINES, Planer Type

Berthiez, Charles, 5 Rue Montalivet, Paris, France
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker, Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Cincinnati Milling Machine Co., Special Machine Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Onsrud Machine Works, Inc., Niles, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MOLDING MACHINES, Plastic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

(*Continued on page 300*)

Hydraulic Press Mfg. Co., Mount Gilead, Ohio

MOTORS, Electric

Brook Motor Corp., 3302 W. Peterson Ave., Chicago 45, Ill.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland 17, Ohio
Onsrud Machine Works, Inc., Niles, Ill.
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic

Barnes, John S. Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers Inc., Administrative & Engineering Center, Box 302, Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE STATION MACHINES, Dial Type

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cincinnati Milling Machine Co., Special Machine Div., Marburg Ave., Cincinnati 9, Ohio
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
National Automatic Tool Co., S. 7th N. St., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Machine Co., Special Machine Div., Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Road, Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch., Tool Co., 2531 11th St., Rockford, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

NIBBLERS, Portable Pneumatic

Buckeye Tools Corp., Dayton, Ohio

NIBBLING MACHINES

Wales-Strippit, Inc., Akron, N. Y.

NUMERICAL CONTROL SYSTEMS—See Electronic Control Systems

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS

Wicaco Machine Corp, Wayne Junction, Philadelphia 44, Pa.

OILERS AND LUBRICATORS

Madison-Kipp Corp., Madison, Wis.
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OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

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PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., De Plaines, Ill.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Walker, O. S., Co., Inc., Worcester, Mass.

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Mummert-Dixon Co., Hanover, Pa.

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S K F Industries, Inc., Philadelphia, Penna.

PIPE, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld

Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.

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Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

PLANER JACKS—See Set-up Equipment


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Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., 3611 Woodburn Ave., Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTICS AND PLASTIC PRODUCTS

Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Press and Bending

PRESS FEEDERS, Automatic

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
U. S. Tool Co., 255 N. 18th St., Ampere, East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
du Mont Corp., Greenfield, Mass.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Allen, Alva Industries, Clinton, Mo.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Denison Engineering Div., American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Northern Hydraulics & Mach. Corp., Melrose Park, Ill.

PRESSES, Blanking, Stamping

Allen, Alva Industries, Clinton, Mo.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering Div. American Brake Shoe Co., 152 Dublin Rd., Columbus 16, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach.. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Denison Engineering Div., American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg., Co., Mount Gilead, Ohio
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

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Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Coining, Embossing

Birdsboro, Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
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Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

(Continued on page 304)

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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Die Tryout

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Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
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Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
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PRESSES, Drawing

Allen, Alva Industries, Clinton, Mo.
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Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
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Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
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L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
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Clearing Div., of U.S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Notching

Allen Alva Industries, Clinton, Mo.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Allen, Alva Industries, Clinton, Mo.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
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(Continued on page 306)

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L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave Chicago 19, Il.
Wales-Strippit, Inc., Akron, N. Y.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Meta-Dynamics Div., Cincinnati 9, Ohio (Hydroform)
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9303 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

Allen Alva Industries, Clinton, Mo.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
B-T Machinery Co., Holland, Mich.
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Il.
Cleveland Punch & Shear Wks., Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering Div., American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PULLEYS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Little Giant Pump Co., 5101 Classen Blvd., Oklahoma City 18, Okla.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio

PUMPS, Hydraulic

Barnes John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Inc., Administrative & Engineering Center, Box 302, Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers Taper, Shell, Adjustable, etc.

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
Cogsdill Twist Drill Co., Greenfield, Mas.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Tomkins-Johnson Co., Jackson, Mich.

REELS, Stock

National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

REFRACTORS Heat-Treating Furnaces

Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS

Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N. Y.

RIVETERS, Portable

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.

RIVETERS, Stationary

Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Tompkins-Johnson Co., Jackson, Mich.

ROTARY TABLES, Optical

Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Michigan

RULES, SCALES AND STRAIGHTEDGES See Machinists' Small Tools

RUST INHIBITORS

Oakite Products, Inc., 26 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular Friction

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoALL Co., Des Plaines, Ill.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

SAW BLADE SHARPENERS

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoALL Co., Des Plaines, Ill.

SAWING MACHINES, Circular Blade

Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

SCREW DRIVERS, STUD AND NUT SETTERS, Power

Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York N. Y.
Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Multiple-Spindle Automatic

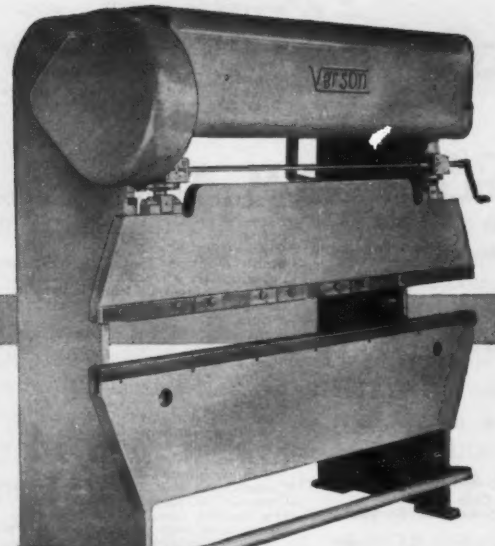
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW MACHINES, Single-Spindle Automatic

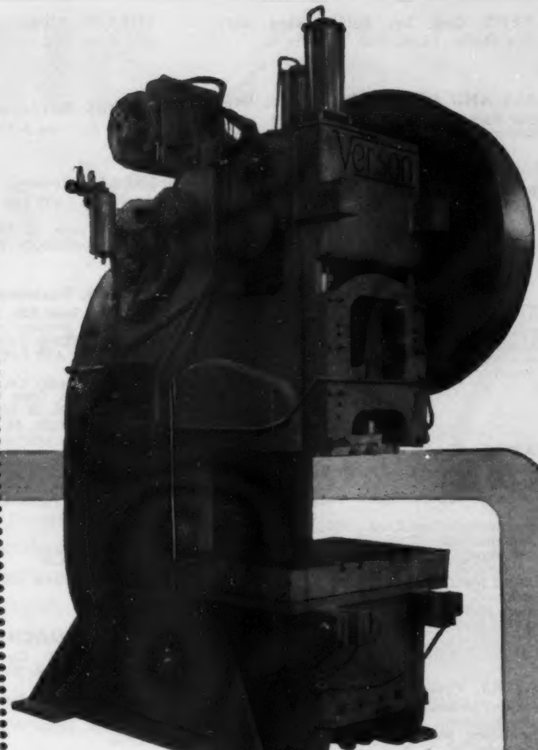
Brown & Sharpe Mfg Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.



Standard Verson Model 1062 Press Brake. This and Model 16-48 are available from stock. Verson offers a complete line of mechanical and hydraulic press brakes in capacities from fifteen tons up.



Verson O.B.I. Presses feature "clean" design, heavy steel plate construction, enclosed gearing and reinforced gap. Also available as permanently upright or permanently inclined.

Verson Press Brakes and O.B.I. Presses provide "Big Press Performance" at modest cost

• Big performance . . . small cost . . . that's the story of Verson 16-48 and 1062 Press Brakes. If you're using a hand brake because you feel a power brake is too expensive or if you're tying up big machines to handle small odd jobs, now is the time to take a close look at these Standard Verson Press Brakes. Here are rugged, efficient power press brakes designed to do a man sized job at minimum cost . . . to bring the advantages of big brake performance to the smaller shop or to handle smaller jobs in the larger shop. Write for complete information.

• Verson Open Back Presses utilize design and construction features normally found only in big expensive machines. As a result, you get the highest standards of accuracy, efficiency and dependability. Verson's quality construction assures greater overall economy because it contributes so much to improved performance, long life and freedom from repairs.

Six Verson O.B.I. models range in capacity from 90 to 250 tons. Verson engineers will be pleased to assist you in selecting an O.B.I. to meet your shop requirements.

194

A Verson Press for every job from 60 tons up.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS—Oil or Grease
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

SEPARATORS, Magnetic
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Lufkin Rule Co., Saginaw, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAPERS, Crank and Hydraulic
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban Kurt, Co., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical and Slotters
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Orban, Kurt Co., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

SHEARS, Guillotine Bar
Beatty Machine & Mfg. Co., Hammond, Ind.

SHEARS, Rotary
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

SHEARS, Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK
Laminated Shim Co., Inc., Glenbrook, Conn.

SLITTING MACHINES, Rotary
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

SOLENOIDS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers Inc., Administrative & Engineering Center, Box 302 Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 839 Green St., Ann Arbor Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield Vt.

(Continued on page 310)


ARMSTRONG
Quality TOOLS
More than meets the eye
There are extra values in ARMSTRONG TOOLS that become apparent only with use.
TOOL SENSE — convenience in use — the most efficient "tool approach" built into ARMSTRONG Tool Holders; the balance and "feel" of an ARMSTRONG Wrench; the rigidity of ARMSTRONG "C" Clamps; the extra toughness of ARMSTRONG Lathe Dogs and Eye Bolts; the universal adaptability of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.
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UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.
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Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keen, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Motch & Merryweather Machy. Co., 888 E. 70th St., Cleveland 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., Box 893 Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
General Electric Co., Schenectady, N. Y.

Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

SPINDLES, Machine

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio

SPRAYING EQUIPMENT, Metal

Metallizing Eng. Co., Westbury, L. I., N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Jessop Steel Co., Washington, Penna.
Ryerson, Jas. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Vanadium-Alloys Steel Co., Latrobe, Penna.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS

Ryerson, Jas. T., & Son, 16th & Rockwell Sts., Chicago 8, Ill.

STOCKS AND DIES

DoALL Co., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire

Bliss Co., E. W., Canton, Ohio.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
U. E. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

STRIP AND SHEET, Ferrous

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jas. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRIP AND SHEET, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Jessop Steel Co., Washington, Penna.
Ryerson Jas. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRUCTURAL SHAPES

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jas. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT

Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

SWAGING MACHINES
Cincinnati Milling Machine Co., Meta-Dynamics Div., Cincinnati 9, Ohio (Intraform)

SWITCHES, Limit
Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

TAPE CONTROL SYSTEMS—See Electronic Control Systems

TAP HOLDERS
Brown & Sharpe Mfg. Co., 235 Promenade St. Providence 1, R. I.
Burgmaster Corp., 15001 S. Figeroa, Gardena, Calif.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.

TAPPING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Stack Ave., Middletown, Conn.
Kato Mfg. Co., Osaka, Japan.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1014 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPPING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Cal.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio.
Cross Co., P. O. Box 3835, Park Grove Postal Sta. Detroit 5, Mich.
Edlund Machinery Co., Cortland, N. Y.
Elox Corp. of Michigan, Troy, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 2, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

TAPS, Hand, Machine Screw, Pipe, etc.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.

TESTING EQUIPMENT Air, Oil & Water Pressure
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

THREAD CUTTING MACHINES
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Gisholt Machine Co., 1209 E. Washington Ave., Madison 10, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio.
National Machinery Co., Tiffin, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

TOOL CONTROL BOARDS
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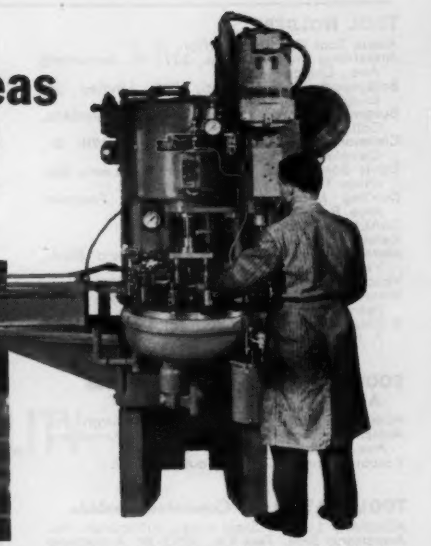
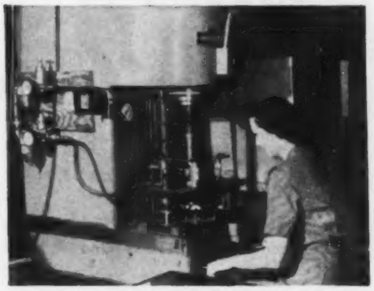
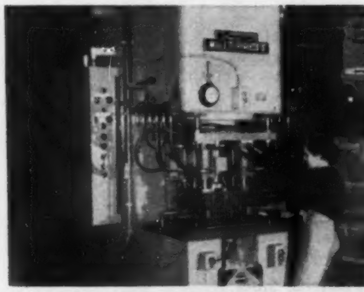
Which of these MULTIPRESS ideas will save you money...NOW?





Toy maker forms 1000 parts per hour . 8-ton Multipress forms metal toys faster, at less cost for Mattel, Inc.



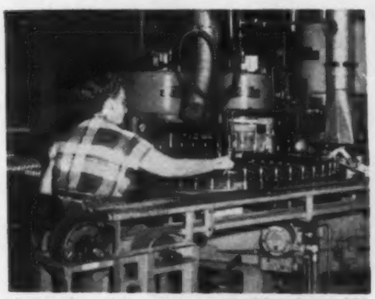
Motorola speeds production...with 100-ton Multipress that precision-punches up to 450 holes at a time in plastic TV chassis bases.

Dormeyer triples production of food mixer parts . . cuts scrap loss, too, with 8-ton Denison Multipress—12-station index table.

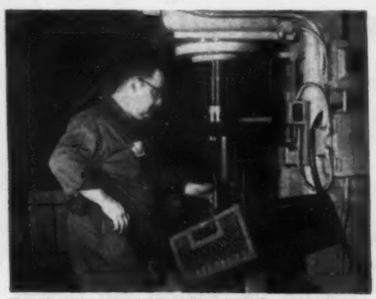
Waterman boosts output 800% with 1-ton Multipress that "angles" precision C/C pen parts fast, at low cost.

Cuts cost 73% on sub-assembly of specialty products at George S Thompson Corp with 4-ton Multipress. Savings—11¢ per unit.

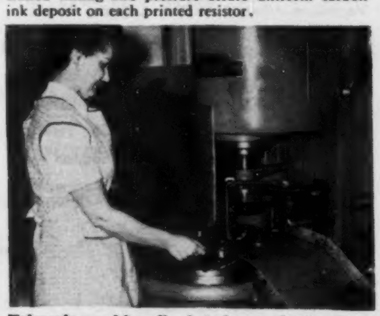
Prints Electronic circuits 3 times as fast at Barry Process Co. with 4-ton Multipress. Controlled timing and pressure assure uniform carbon ink deposit on each printed resistor.



Auto-lite automates assembly of over 150 different types of spark plugs with a battery of 3 Multipresses operating around a 48-station index table.



Production up 33% at Cleveland Graphite Bronze—where 25-ton Multipress compresses soft carbon cores at the rate of 100 per hour.



Trimming rubber flash twice as fast... 4-ton Multipress with 6-station index table trims flash from 2400 molded rubber parts per hour. Old method called for 3 operations.

Time and money savings like these are only a few of hundreds that Denison Multipress can help you make in keeping ahead of competition today.

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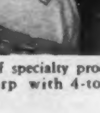

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Vascoloy-Ramet Corp., Waukegan, Ill.
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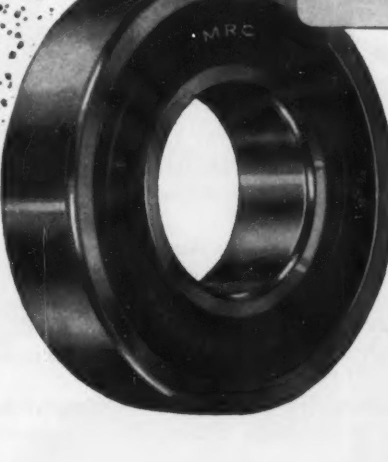

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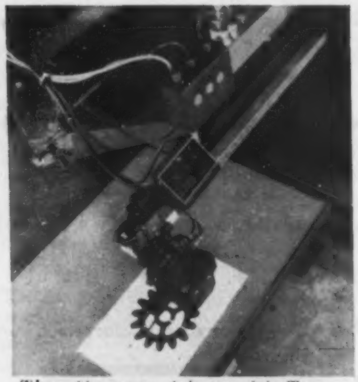

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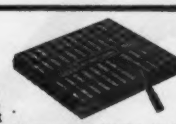

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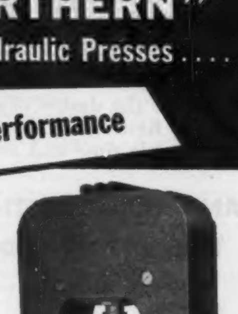

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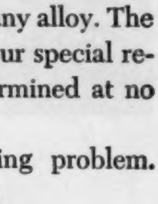

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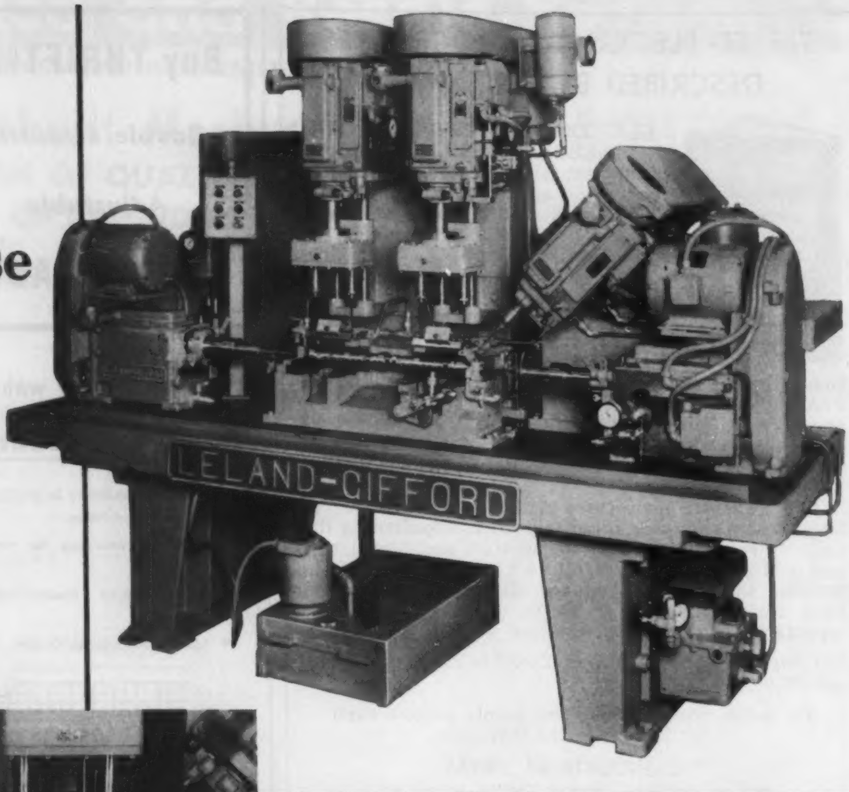

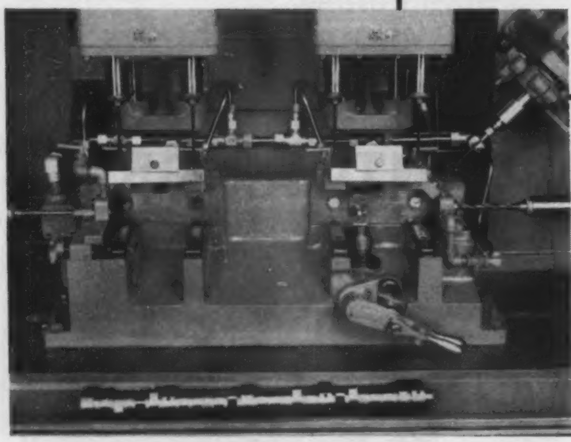

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